MACHINERY is registered as a newspaper at the General Post Office and the name is a registered trade mark

Published every Friday by
The Machinery Publishing Co., Ltd.

Price 1/3

•

LESLIE R. MASON
Managing Director

CHARLES H. BURDER
Editor

•

EDITORIAL OFFICE

REGISTERED OFFICE, SMALL AND CLASSIFIED ADVERTISEMENTS DEPARTMENT AND ENQUIRY BUREAU

CLIFTON HOUSE
83-117 EUSTON ROAD
LONDON, N.W.1.

Telephone: Euston 8441/2
Telegrams: Machtool, Norwest, London

•

HEAD OFFICE

SUBSCRIPTION, ADVERTISEMENT, SERVICE, PHOTOGRAPHIC, ACCOUNTS AND BOOK DEPARTMENTS

NATIONAL HOUSE
21 WEST STREET
BRIGHTON, 1.

Telephone: Brighton 27356 (3 lines)

Telegrams Machtool, Brighton

NEW YORK: 93, Worth Street

PARIS: 15, Rue Bleue

•

SUBSCRIPTIONS:—Inland and overseas, 52 shillings per annum, post free. Cheques and Money Orders should be made payable to the Machinery Publishing Co., Ltd.

ADVERTISEMENTS:—Copy for displayed advertisements, if proofs are required, should reach the Brighton office 21 days in advance of publication. Rates on request. Small (classified) advertisements can be accepted, space permitting, at the London office up to Saturday morning for publication on the following Friday. For rates, see p. 171. Blocks are held at advertisers' own risk; no responsibility for loss is accepted by the publishers.

MANUSCRIPTS FOR BOOKS covering all branches of engineering production will receive careful consideration and should be sent to the Manager, Book Dept., MACHINERY, National House, 21 West St., Brighton, 1.

MACHINERY

A JOURNAL OF METAL-WORKING PRACTICE AND MACHINE TOOLS

Vol. 92, No. 2368 April 4, 1958

COPIES PRINTED .... 11,500 per week

CERTIFIED DISTRIBUTION .... 11,376 per week

CERTIFIED PAID DISTRIBUTION .... 10,566 per week

CONTENTS

Abstracts of Principal Articles

In this, the first of a series of articles on the production methods employed for the new Vauxhall Victor, the car is first briefly described, and attention is drawn to the new features of the 1½-litre engine. Reference is then made to the re-arrangement of the large building, erected in 1950, in which most of the mechanical components of the car are produced. The design of the gearbox is then outlined, and special consideration is given to the newly-introduced synchromesh mechanism for the engagement of first gear. Next, the machining line for the gearbox castings is discussed. On this line, after shot-blasting in a special plant, the cover face of the box-shaped casting is rough-milled, drilled and broach-finished on a rotary machine, and the end faces are then rough- and finish-milled on another similar unit. On both machines, the automatic cycle is controlled electrically, with the aid of hydraulic valves, that are operated in the correct sequence by a camshaft. A Snyder 53-station in-line transfer machine then performs all the remaining operations with the exception of fine-boring of the mainshaft and other bores. This machine has three sections, which operate successively on the sides, the ends, and the internal and top faces of the casting, and turn-round and turn-over stations are interposed between the sections. From the transfer machine, the castings pass through a washing unit to an Ex-Cell-O fine-boring machine, and are then inspected with the aid of Solex equipment, before they are delivered to the assembly line. (MACHINERY, 92—4/4/58.)

In this seventh article in a series describing some of the methods employed by the Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, some further aspects of ball and roller cage production are discussed. Archdale heavy-duty drilling machines are employed for machining the pockets in large ball cages up to 28 in. diameter, and roller cages up to 30 in. diameter. A profile-boring technique is used to reduce the number of broaching passes subsequently necessary, in machining square radial pockets in certain types of roller cages. As far as possible, de-burring is carried out by mechanical means, and on one special-purpose machine, a double-row ball cage, with 13 pockets per side, is de-burred by a skilled operator in 10 sec. Final finishing of machined cages up to 5 in. diameter is performed by the Roto-finish process. (MACHINERY, 92—4/4/58.)

The follow-on press tool here described incorporates a blanking die of solid tungsten carbide, which is employed in conjunction with a high-speed steel punch. This punch was used in conjunction with a temporary Kirksite die to blank laminations from brass strip. Electrodes were then built up from the brass blanks, and employed for machining the die opening by the Sparcatron process. The operation was carried out in three stages with a roughing and two finishing electrodes, after the blank had been prepared by spark machining ⅛-in. diameter holes all round the aperture. At the final stage, a part of the profile, for which particularly close limits are specified, is completed. (MACHINERY, 92—4/4/58.)

For rapidly checking and grading threaded tap blanks, an automatic machine has recently been designed and constructed by Aktiebolaget C. E. Johansson, Eskilstuna, Sweden. This machine, which is arranged for hopper feed, is equipped with two El-Mikrokator instruments, and will handle threaded components from 2 to 20 mm. diameter at rates from 1½ to 3 sec. each. Taps are classified as "high," "low," and first and second grade, and the latter are delivered into separate containers. Reference is also made to an automatic roll-marking machine whereby the makers name and other information is impressed in the shanks of tap blanks at the rate of 3,000 per hour. (MACHINERY, 92—4/4/58.)

It is pointed out that the ventilation of factory buildings is particularly important during the early stages of an outbreak of fire in order that heat and smoke can escape. In this way, the spread of flame can often be limited until firemen can gain control. If ventilation in such circumstances is to be effective it must be provided automatically by a temperature sensitive arrangement. Some notes are included on the extent of venting, and two typical installations are illustrated. (MACHINERY, 92—4/4/58.)

Two components for the PowerFlite automatic transmission made by the Chrysler Corporation, U.S.A., which were formerly turned from steel bar stock, have now been replaced, with considerable advantages, by an impact extrusion and a die casting, both of aluminium alloy. The components in question are a transmission reverse servo piston and piston sleeve, and the majority of the light operations required are carried out on 2- and 4-spindle fine-boring machines. The principal set-ups are illustrated and described. (MACHINERY, 92—4/4/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

Improving Edge Finish of Blanked Parts

For the production of a wide variety of components, including many of very intricate forms, blanking from strip or sheet material, either at one stage or a number of stages, is frequently an extremely economical method, particularly if the layout is carefully studied to ensure that the amount of scrap stock is reduced to a minimum. Blanking may, of course, be followed by bending and forming operations to obtain the finished shape desired, but it is the initial stage that determines the accuracy of outline and quality of edge surfaces. Press tools of very high standard are now widely employed where the work is of an exacting nature, and enable blanks of good quality to be obtained. The inherent action of orthodox punches and blanking dies, however, is such that, particularly when parts are made from fairly thick materials, edge finish and uniformity often leave much to be desired.

There are, of course, various ways in which the dimensional accuracy and edge surfaces of blanks can subsequently be improved. For this purpose the shaving process, whereby a small amount of metal is removed from the periphery of a slightly oversize blank, by means of a reciprocating die, is often very effective. In other instances, milling or grinding operations may be carried out in order to achieve the necessary limits and smoothness over certain portions of the profiles. Barrel finishing can also be employed with good results for many parts of a somewhat different nature, for removing burrs and sharp corners and obtaining a general improvement in finish. Because the blanking process is so rapid and efficient, however, secondary operations, particularly where they involve individual handling and loading, may add quite disproportionately to the finished cost of components.

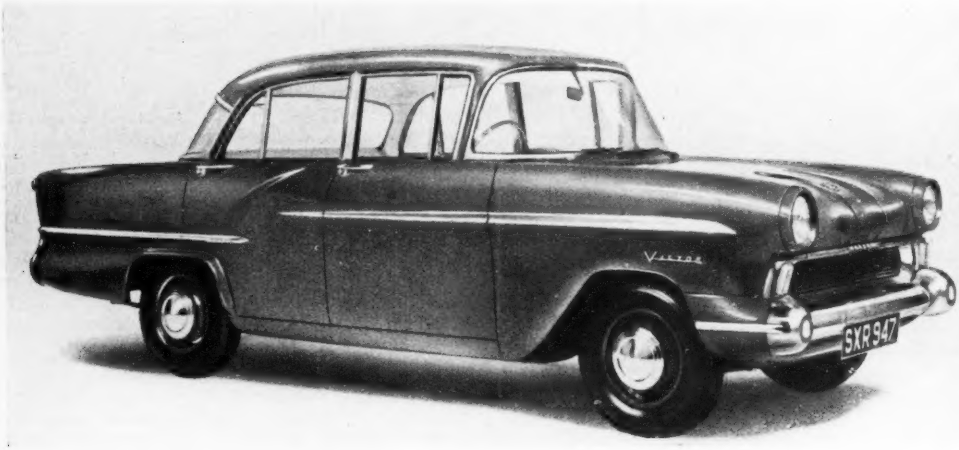
In these circumstances it is evident that methods whereby initial blank quality can be substantially improved deserve the most careful consideration. Attention was drawn to one such process, for which important advantages are claimed, in a recent issue of MACHINERY. For this method, tools of high quality and specially-designed hydraulic presses are required. The material, it is stated, is held firmly while the blank is being cut so that it is only sheared on the desired line and is not subject to the tearing or breaking that occurs with conventional blanking and results in indifferent edge surfaces. Blanks with well-finished, sharp corners, in plan, cannot be produced by this technique, nor is it applicable to all materials. For a wide range of work, however, it is said to enable close limits of accuracy to be maintained, with edge surfaces comparable to those obtainable by subsequent machining. The process is necessarily considerably slower than conventional blanking, but where it enables parts to be virtually completed at one stage, there may be substantial overall economies.

Another method of obtaining improved blank edge surfaces was discussed by Mr. R. Tilsby, A.M.I.Mech.E., and Mr. F. Howard, A.M.I.Mech.E., during the course of a paper presented at the recent conference on Technology of Engineering Manufacture which was organized by the Institution of Mechanical Engineers. This paper was concerned with the results of some work carried out by the Production Engineering Research Association, with which both the authors are connected, and the method involves the provision of a very small clearance between the punch and the die, and a small polished radius instead of a sharp corner, all round the die opening. It is stated that tooling of this type appears first to have been employed in the watchmaking industry, but, so far as is known, no information concerning clearances and radii has hitherto been published.

The investigations carried out showed that the process could be successfully applied to certain components in both ferrous and non-ferrous metals, and, contrary to what might have been expected, it was found that the substitution of a radius for a sharp edge on the die had little effect on the blanking load. This "finish blanking" technique, as it is termed, cannot be universally applied. For example, the component must be sufficiently rigid to withstand the lateral or radial pressure exerted on the sides, otherwise dishing will occur. Presumably, also, the limitations as regards blanks with sharp corners in plan would again apply. Subject to these restrictions, it is stated that, in addition to non-ferrous metals, straight-carbon, and even alloy steels, can be finish blanked to give a sheared surface condition which is "at least comparable to, and in many cases better than," that obtained by shaving.

It is not suggested that these new blanking methods will enable secondary finishing operations to be entirely eliminated. On the other hand, it does appear that many components, for which subsequent processing has hitherto been specified, will be suitable for service with no more than light deburring operations, and it is obvious that important economies will thus be achieved.

H2



Producing the Vauxhall Victor

High-quantity Methods Employed by Vauxhall Motors, Ltd., Luton

When the decision was taken, some three years ago, to produce an entirely new unit to replace the Wyvern in the range of cars made by Vauxhall Motors, Ltd., it was decided that it should be of normal size rather than of "baby" proportions. Extensive studies had shown that there is an optimum size for a car giving the maximum value for the minimum price, and any reduction below this optimum size lowers the value of the car out of proportion to the reduction in cost. With such considerations in mind, the new car was designed as a 4-door saloon to seat four adults in comfort, with a 4-cylinder engine of 1½ litres capacity. As may be seen from the heading illustration, the new Victor car is of advanced appearance and embodies a fully wrapped-round windscreen, the first to be fitted to a British car. The rear window also extends well round towards the sides of the car, so that visibility is remarkably good in all directions.

Production of the Victor body is carried out in an entirely new building at Luton, which includes an extensive press shop, laid out on the most modern principles, and the bodies are assembled largely by multi-spot welding techniques, in accordance with the latest practice. This shop, and the production and assembly of the bodies, will form the subjects of later articles in this series. Unitary construction is employed for the combined chassis-body structure of the car, and there are two long box-section pressings on the underside which provide attachment points for the semi-elliptic springs of the rear axle assembly. The rear axle is of built-up construction, with a cast housing which is machined on an automatic transfer machine, and its production will also be discussed in later articles.

At the front of the car, a substantial cross-member carries the independent wheel suspension units. These units incorporate forged steel steering knuckles that are machined on an in-line transfer machine, to be described later. Small wheels, fitted with tyres of 5·6 by 13 in., are employed to give a low unsprung weight, and the design of the car is such that a low centre of gravity is obtained, reducing pitch, roll and brake-dive effects. All the mounting points between the suspension and the engine and body have been designed with a view to reducing the transfer of noise and vibration as far as possible, and, to decrease transmission noises, cast iron has been adopted instead of aluminium for the gearbox and clutch housing. These two components are made as separate castings and transfer machines are provided for certain of the operations associated with their production. Noise transmission is also reduced by spraying the underside of the car with plastics sound-deadening material during manufacture.

ENGINE DETAILS

Although the design of the Victor engine is based largely on experience gained from that used in the Wyvern, it has several new features which have improved the maximum power output by about 10 per cent. A three-point engine mounting system is employed to reduce noise transmission. The modern design employs a bore and stroke of 3⅛ and 3 in. respectively, the compression ratio is 7·8 to 1, and the engine has a maximum power output of 48 b.h.p. (nett) at 4,200 r.p.m. Among the more important features of the engine, it may be noted that the skirt of the crankcase is taken well below the crankshaft axis, resulting in a more rigid casting and allowing a single gasket to be employed for the joint face. Pistons for the new engine are made on a production line that incorporates much interesting equipment, and the gudgeon pin bores are offset by $\frac{1}{16}$ in. When the pistons are assembled, this offset is located on the thrust side of the cylinder (that is, the side opposite to that on which the crankpin descends), so that movement of the piston in the cylinder during the change in angularity of the connecting rod at top-dead-centre takes place in two stages. Piston slap is thus reduced.

A high-duty iron camshaft is employed, with chilled cams which are claimed to have wearing qualities superior to those of case-hardening steel. As compared with the Wyvern engine, large inlet valves, of $1\frac{7}{16}$ in. diameter, are fitted, and engine breathing has also been improved, by the use of a re-designed induction manifold and cylinder head with individual inlet ports. A new, more compact Zenith carburettor has permitted a reduction in the overall height of the engine.

In addition to much special equipment, rotary and in-line transfer machines are employed for operations on cylinder blocks and heads, bearing cups, induction and exhaust manifolds, crankshafts, connecting rods, oil pump housings and water pump bodies, besides those mentioned earlier, and it is intended, in later articles, to give details of the more interesting machines and operations employed for all these parts. In the present article, and in others to be published shortly, operations on certain components and the main casting for the gearbox will be discussed, but, first, it may be of interest to give some details of the factory in which this work is carried out.

NEW FACTORY EXTENSIONS

As reported in MACHINERY, 76/549—13/4/50, and 77/612—7/12/50, the machine shop, in which most of the mechanical units for the Victor are produced, was built in 1950, and covers an area of 19½ acres. The building is rectangular in shape and is nearly one-third of a mile long by 480 ft. wide, the manufacturing area being all on one level. At one end, there is a basement employed as a stores, with an area of 77,000 sq. ft. At the same end, a two-storey office building houses the planning and other departments associated with production operations. Initially, the building was employed mainly for the production of components for Bedford commercial vehicles, although many passenger car components were also produced. With the £36,000,000 expansion scheme recently announced by the company, it was decided to concentrate most of the commercial vehicle production in a new plant to be built at Dunstable, and this building has now been erected and occupied. Another new building at Dunstable, now almost completed, is to be used for the storage, packing and sales of spare parts and accessories, so that much space at Luton is released for passenger car manufacture.

As may be imagined, the movement of the machinery employed for truck manufacture to another site, and the re-arrangement and installation of the new plant required for the Victor and existing passenger car production, created a major upheaval at the Luton works, and it reflects great credit on the management that they were able to maintain production under such conditions. During the re-arrangement of the factories, which lasted for a period of just over two years, more than 3,000 existing machines were re-sited. In the same period, some 2,112 new machines, costing about £16,000,000, were specified, purchased and installed. Probably the most impressive part of the installation is the line for machining operations on cylinder blocks which comprises 15 machines, including what is claimed to be the largest automatic transfer machine in Europe. This line is planned to perform a total of 1,400 separate machining operations on each block, at the rate of 65 blocks per hour, and is tended by only 14 men.

THE VICTOR GEARBOX

A cut-away view, Fig. 1, shows the internal arrangements of the assembled Victor gearbox, with the rear extension and clutch housing castings in position. As noted earlier, the gearbox is separate from the clutch housing and rear extension, and is cast in grey iron to reduce transmission noises. The gearbox provides for three forward ratios and reverse, and is noteworthy for the incorporation of synchromesh on all three forward speeds. The enlarged view inset in Fig. 1 shows details of the synchromesh mechanism for the

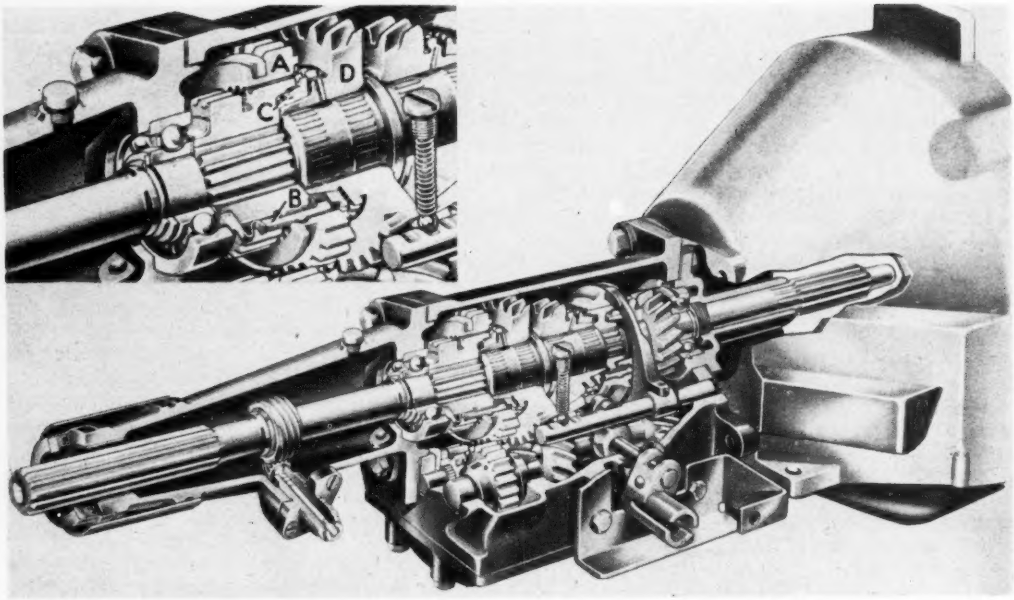
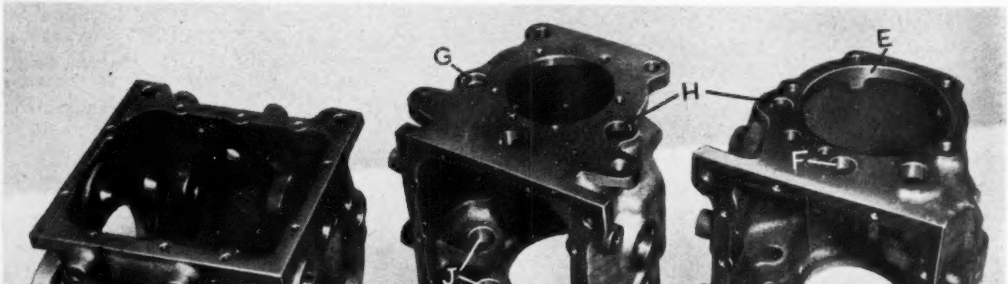


Fig. 1. The Gearbox of the Vauxhall Victor is a Box-shaped Casting to which is Secured the Clutch Housing and the Rear Extension. Details of the Synchromesh Mechanism May be Seen Inset

Fig. 2. Three Finished Gearbox Castings Showing Some of the Machined Surfaces and Holes. The Uppermost Face of the Casting at the Right is Designated the Rear Face on Account of its Position when the Gearbox is in the Car

first speed, from which it may be seen that there is a first speed clutch *A*, with internal teeth, with reverse gear teeth machined externally. The internal teeth engage a clutch hub, on the splines of the mainshaft, and three keys *B* slide in longitudinal grooves in the clutch hub, whereon they are anchored by springs. When the clutch *A* is moved towards the rear end of the gearbox, its external teeth mesh with those of the reverse idler gear below. Movement of the clutch *A* in



the opposite direction carries the three keys *B* to the right, so that their ends press against the synchro-mesh cone *C*. The tapered internal surface of the cone is thus moved into contact with the corresponding external cone on the constant-mesh, first speed gear *D*, accelerating it to the same speed as that of the clutch and the mainshaft. Further movement to the right then engages the internal teeth of the clutch *A* with the dog teeth on the synchro-mesh cone and the first speed gear *D*, in succession.

reverse speed clutch hub, and will be described later, with some of the more interesting operations on the mainshaft, in which oil grooves are formed on a spline-rolling machine; striking levers and forks; and front and rear extensions which carry the mainshaft ball bearings.

Many of the components employed in the Victor are common to the more recently announced Velox and Cresta cars, which incorporate 6-cylinder engines and are of entirely new design. Components for these larger cars are produced by

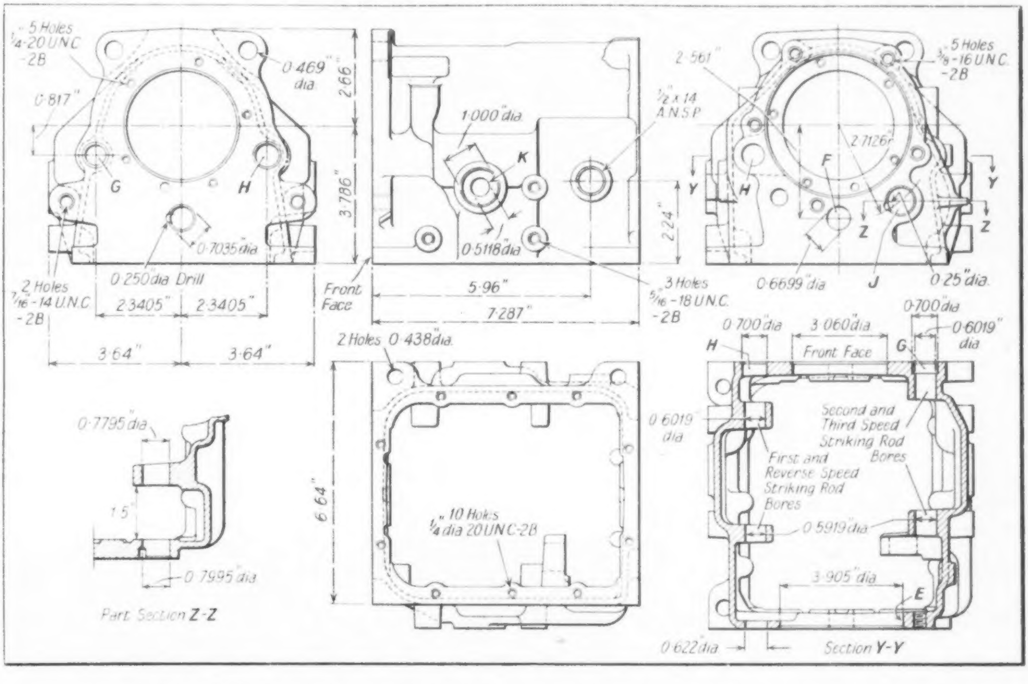


Fig. 3. Details of the Machined Gearbox Casting. On the Snyder Transfer Machine the Casting is Turned so that the Rear Face is Successively Leading, at the Right, and Facing Upwards

Some of the most interesting operations in the production of the gearbox components are carried out on the layshaft cluster gear, which has four sets of teeth cut on different diameters, and is situated directly below the mainshaft in the gearbox. Three of the sets of teeth are cut on a battery of six Rigid-hobbers (Churchill Gear Machines, Ltd.), arranged for completely automatic loading and unloading, and this installation was fully described in MACHINERY, 90/269—1/2/57. A somewhat different arrangement is adopted for the first and

methods that are generally similar to those used for the Victor, and, in this series of articles, attention will be drawn to any interesting variations in the machining techniques adopted for the two other units.

MACHINING THE GEARBOX CASTING

Three views of completely machined gearbox castings are given in Fig. 2. The gearbox rear extension casting is fitted to the end seen uppermost on the right-hand casting. This end has the

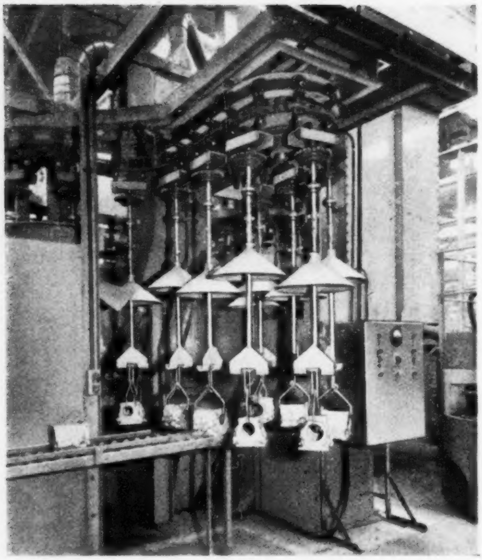


Fig. 4. The First Machining Operation on the Gearbox Casting is Preceded by Shot-blasting in this Automatic Conveyorized Plant

largest mainshaft bore *E*, and is known as the rear end from its position when installed in the car. Adjacent to the bore *E* is a smaller hole *F*, which accommodates the layshaft cluster gear shaft mentioned above, and, on each side, are two further bores *G* and *H*, for the striking lever shafts. At one end of the casting are two bores *J*, in line, for the reverse idler gear, and a transverse or cross-shaft for moving the striking forks is accommodated in two bores in the sides of the casting, one of which is seen at *K*. Some further details of the machined casting are seen in the drawing, Fig. 3, where the bores so far mentioned are lettered to conform with Fig. 2.

After delivery from the supplier, the casting is first shot-blasted all over, and, since considerable importance is attached to this operation, a special plant has been installed whereby it is carried out automatically, apart from loading and unloading. This plant is housed in an enclosed room to prevent the escape of dust to the atmosphere of the shop, and a general view is given in Fig. 4. Supplied by St. George's Engineers, Ltd., the plant has a conveyor system with a track, of roughly pear-shape, from which is suspended a number of hangers. Each hanger has two hooks at its lower end, and the lengths of the hooks are such that they hold the castings with the joint face horizontal. Near the mid-point of each hanger, there is a bell which prevents the passage of shot upwards from the plant, and at the top of the hanger is fitted a roller-chain sprocket.

The shot-blasting cabinet is roughly U-shaped in plan. Conveyor hangers enter the cabinet through doors of thick sheet rubber, in the inner side of one leg of the U, traverse round the interior of the cabinet in an anti-clockwise direction, and emerge through rubber doors in the other leg of the U. Outside the cabinet, along the lower portion of the U-shape (that is, at the rear of the cabinet) there is a drive mechanism for the sprockets on the hangers. This mechanism consists of an endless length of roller chain, which passes over sprockets at each end of the cabinet, that are driven by a small electric motor, through V-belts. As each hanger moves into the cabinet, its sprocket is carried into mesh with the continuously-moving roller chain. In consequence, the casting carried

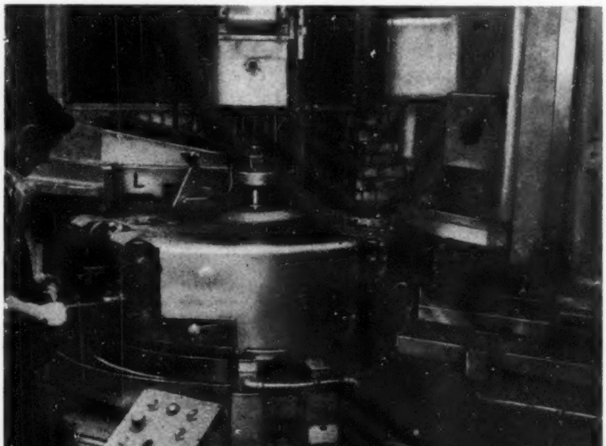


Fig. 5. From the Shot-blast Plant, Castings are Delivered by an Inclined Roller Conveyor to this Machine for Rough-milling, Drilling and Finish-broaching of the Cover Face

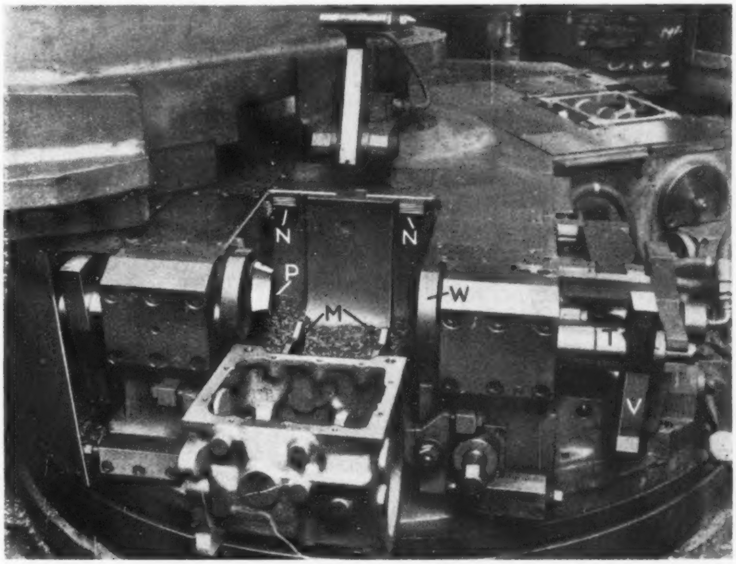


Fig. 6. Close-up View of One of the Fixtures on the Machine in Fig. 5, with a Machined Casting which has Just Been Unloaded in the Foreground. The Two Large Holes in the Cover Face are Employed for Locating the Casting at Subsequent Operation Stages

on it is rotated slowly, as it passes through the sprays of shot, which are directed from above and below so that all surfaces are treated. A large-capacity dust extraction plant is installed in the shot-blast room, also a shot hopper, to which spent shot is returned after passing through a filter for the removal of broken particles and other foreign matter before it is re-circulated. The dust extractor and shot-hopper also serve another special plant in the same room, employed for the gearbox extension, as will be described later. Gearbox castings are brought into the room in box pallets, and are loaded manually on to the hangers. Treated castings are taken from the hangers and placed on the end of the inclined roller conveyor seen on the left in Fig. 4, and travel by gravity to a position adjacent to the first machine in the gearbox line.

CINCINNATI MILLING, DRILLING AND SURFACE-BROACHING MACHINES

Two Cincinnati machines are employed for operations on the castings before they reach the automatic transfer machine mentioned earlier. One machine is used for milling, drilling and surface broaching, and the other for milling only, and the first of these is seen in Fig. 5, where the operator may be seen engaged in loading one of the three fixtures on the indexing table. On this machine, the bottom cover face of the casting is first rough-milled by the horizontally-moving spindle head at the right, the spindle of which is fitted with an 8-in. diameter Galtona (Richard Lloyd, Ltd.) Shear Blade cutter, with 28 carbide-tipped, inserted blades. The head is driven by a 5-h.p. motor, and the cutter is run at a speed of 95 r.p.m., to provide a surface speed of approximately 200 ft. per min. A feed rate of 20 in. per min. is employed, giving a tooth loading of about 0·0075 in., with a depth of cut of up to $\frac{3}{16}$ in.

From the loading station, the table is indexed in an anti-clockwise direction to the rough-milling station, and, at the next indexing movement of the table, the casting is carried to a position beneath the multi-spindle drill head seen at the rear in Fig. 5. This head and the vertical column on which it is supported, were supplied by William Asquith, Ltd. (Drummond-Asquith (Sales), Ltd.), to Cincinnati Milling Machines, Ltd., who designed and built the machine.

The drill head is employed for machining 12 holes in the cover face. Two holes are of 0·437/0·438 in. diameter, and ten of 0·212 in. diameter (No. 5 drill) to be subsequently tapped ¼ in. by 20 U.N.C. Drill-reamers are employed for the larger holes, so that they will be sufficiently accurate for use in locating the casting at later machining stages, and these tools are run at a spindle speed of 810 r.p.m. The small drills are run at 1,080 r.p.m., and the head is fed downwards at a rate of 3·81 in. per min.

At the next indexing motion of the table, the drilled casting is carried beneath the bridge member *L*, back to the loading position. A surface broach, with six downward-projecting teeth, is secured to the underside of the bridge member, and, as the casting is traversed beneath it, each tooth removes approximately 0·001 in. of metal from the cover face, leaving a flat, smooth

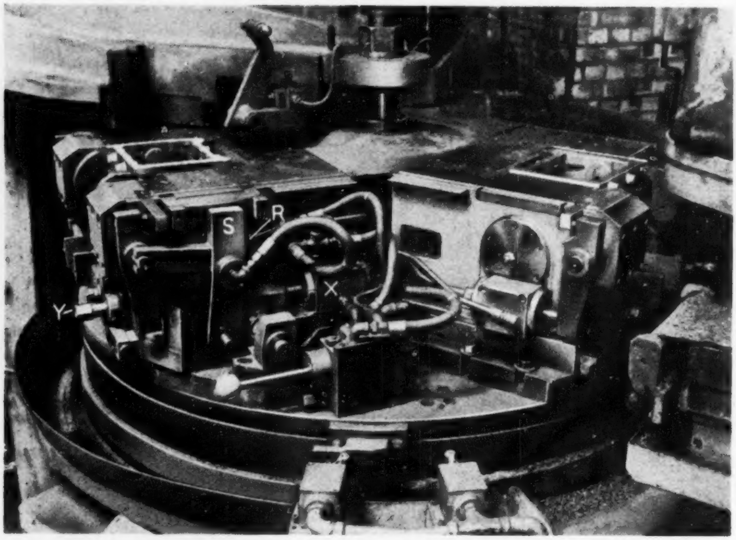


Fig. 7. In this View of the Fixture on the Machine in Fig. 5, the Guards have been Removed so that Details of the Hydraulically-operated Clamping Mechanisms May be Seen

surface. The speed at which the table is rotated gives a broaching speed of about 18 ft. per min., and the table is driven by a 7½-h.p. motor, through spur reduction gears and a worm and wheel. Location of the table for milling and drilling is by means of a dowel pin connected to a hydraulic cylinder, and the table is securely clamped between the indexing movements by four other hydraulic cylinders.

Three identical fixtures are employed to hold the castings, and are operated hydraulically, pressure-oil being supplied through the table centre pivot, by way of rotary connections. A close-up view of one of the fixtures, from directly in front, is given in Fig. 6, with a casting which has just been unloaded in the foreground. The casting is loaded with the smaller mainshaft bore at the left. It is placed on the nearer ends of two hinged, counter-balanced bars *M*, and is pushed into the fixture until its far side rests against two serrated clamping pads *N*. In this position, the curved under-side of the casting rests in V-grooves in the upper surfaces of the bars *M*, and it is held at such a height that the mainshaft bores are roughly aligned with two locating bungs. One of the bungs, of a triangular, tapered shape, is fixed in position, and may be seen at *P*.

Another view, showing opposite sides of two of the fixtures, is given in Fig. 7, where the clamping arrangements are clearly shown. Clamping is effected by means of a valve actuated by the white ball-handled lever near the centre in Fig. 7, which allows oil to pass to three cylinders. One of these cylinders, which is indicated at *R*, is horizontally mounted within the fixture casting, and its piston rod carries the other locating bung, of a similar shape to the fixed bung *P*, Fig. 6. The end of the piston rod remote from the location bung extends outwards from the fixture, and bears a T-shaped member S, which is anchored to the fixture body at its lower end. The vertical leg of the member *S*, above the point at which it is coupled to the piston rod, presses against a horizontal, clamping bar. The ends of this bar engage notches in two horizontally-disposed spring-loaded plungers, of square section. Under the action of the clamping cylinder *R*, the square-section plungers thrust the casting sideways on to the fixed bung *P*, Fig. 6, and it is clamped endwise against two serrated pads on the further side of the fixture (that is, at the left in Fig. 6). At the same time, the movable locating bung is inserted in the larger mainshaft bore.

The horizontal leg of the member S has a fork-end which engages flats on a sliding plunger *T*, Fig. 6, so that as the square-section side clamps are applied, this plunger also is moved to the left. The plunger carries a lever *V*, at one end, and a clamping arm *W*, at the other, and, when it is thrust to the left, the clamping arm is moved to a position in front of the casting. Simultaneously, the lower end of the lever *V* is aligned with the end of an extension on the ram of another cylinder *X*, Fig. 7. When oil is supplied to this cylinder through a pressure-operated valve, the ram is advanced against the lower end of the lever *V*, thus turning the plunger *T* and applying clamping pressure through the arm *W*. At the same time, oil is supplied to another cylinder (on the left-hand side of the fixture as viewed in Fig. 6) to operate a similar clamping arrangement, which may be seen on the fixture at the right in Fig. 7.

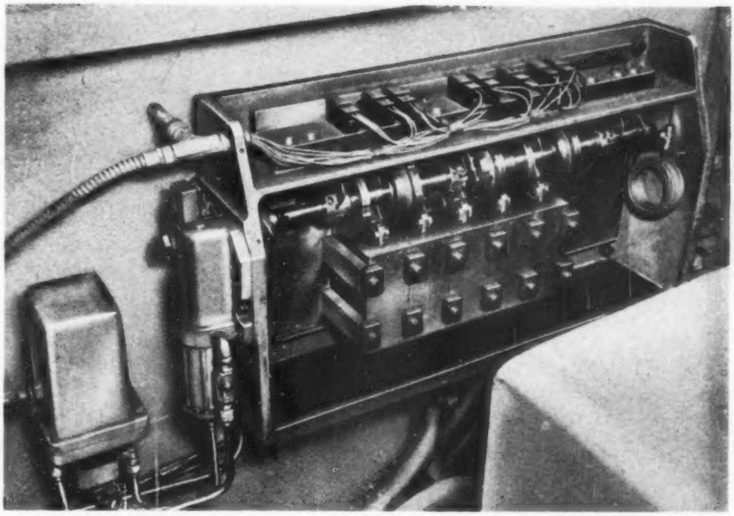


Fig. 8. The Automatic Cycle of the Machine in Fig. 5 is Controlled by Hydraulic Valves which are Operated in the Correct Sequence by a Camshaft, Indexed, through a Ratchet Mechanism, by Successive Strokes of the Cylinder at the Left

By these clamping units, the casting is moved to the left and clamped at the two short sides, before it is clamped on the two long sides.

In order to ensure that the holes are drilled in the casting in the correct positions, in spite of variations that may occur between castings in different batches, each fixture is mounted on dovetail slides, and may be moved bodily sideways, by means of a lead-screw. After a clamping screw, seen being turned by the operator in Fig. 5, has been loosened, the lead screw can be rotated by applying a box-spanner to the hexagon-end of the shaft Y. The optimum position of the casting is determined with the aid of a swinging gauge, mounted on the bridge member which carries the broach. When the gauge is lowered, a hardened adjustable stop at the extremity of the arm should contact one end wall of the casting. To ensure that the table is not accidentally indexed with the gauge in the advanced position, a limit switch is actuated when the gauge-arm is swung back, and the circuit must be completed before the push-button, whereby the automatic machine cycle is initiated, becomes operative.

The automatic cycle is controlled electrically, with the aid of the hydraulic valves shown in Fig. 8. These valves are operated in the correct sequence by a camshaft, which is indexed by a ratchet mechanism coupled to a hydraulic cylinder at the left, the oil supply to the cylinder being regulated by solenoid valves. This mechanism, also the spaces between the fixtures in which the clamping mechanisms are accommodated, are normally covered by guards, but in the illustrations these guards have been removed.

Alongside the machine just described is another Cincinnati unit, of similar proportions, and a view of this machine which is employed for rough- and finish-milling operations on the end-faces of the gearbox, is given in Fig. 9. Here, a hydraulic control valve unit, similar to the unit considered above, is housed beneath the cover seen at the lower left-hand side. The machine has a central table, equipped with four clamping fixtures, and the indexing-mechanism moves the table in increments of 90 deg. Slideways at each side of the machine support 2-spindle straddle-milling heads, the head on the left being employed for roughing and that on the right for finishing. For the roughing operation, the spindles are driven, by separate motors of 15 h.p., at a speed of 100 r.p.m. They are fed at a rate of 17 in. per min., and the depth of cut ranges up to $\frac{3}{32}$ in. per side. Motors of 5 h.p. are employed for the spindles on the finishing head, which are driven at a speed of 125 r.p.m. The feed rate for finishing is 20 in. per min. and the depth of cut 0·030 in. per side.

A close-up view of the machine, Fig. 10, shows the Galtona Shear Blade cutters, of 8 in. diameter, which are fitted to all four spindles. These cutters each have 24 carbide-tipped inserted blades and the cutting load is about 0·007 $in.^3$ per tooth. The cutters are set at the correct distances apart with the aid of gauges, fitted into two of the fixtures at the start of the cutter-changing operations.

Some details of the work fixtures may also be seen in Fig. 10. Each has a base-plate to support the casting, the latter being located by two dowels near the front of each unit. Clamping is effected by a centrally-pivoted beam, and the end of the beam nearest to the table centre can be lifted by a hydraulic cylinder. The beam has a cross-bar

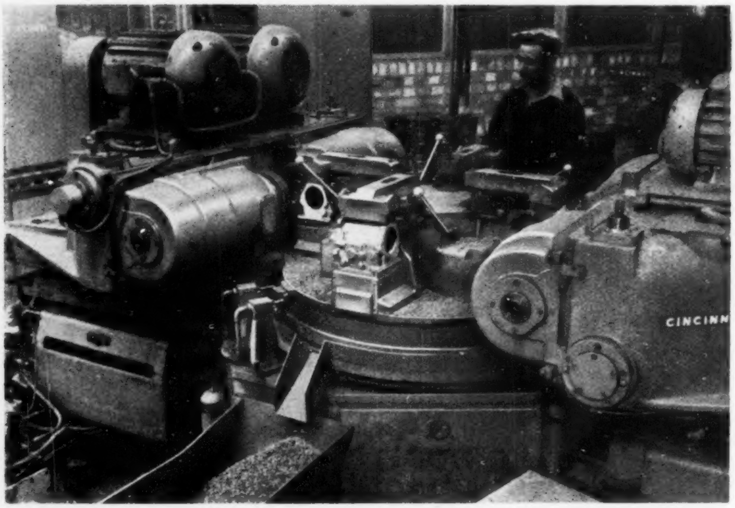


Fig. 9. A Second Machine, of Somewhat Similar Construction to the Unit in Fig. 5, is Employed for Rough- and Finish-milling the End Faces of the Gearbox Casting, and is Controlled by a Camshaft and Valve Mechanism Beneath the Cover at the Lower Left

at the end remote from the cylinder, and pressure is applied to the casting through floating spring-anchored pads at either side of the cross-bar. Clamping is initiated by operation of the appropriate white-handled lever, and the beam first descends to clamp the casting. Pressure-oil is then diverted to two small hydraulic cylinders mounted horizontally on each side of the beam. The rams of these cylinders extend towards the table centre, and each is connected to a small square-section thrust bar, as indicated at Z. As pressure is applied to the cylinders, the thrust bars are pushed hard against the casting at each side to support it against the cutting pressure, and to reduce vibrations which might mar the surface finish. The cycle times of the first two machines are about 40 sec. and an output of about 70 castings per hour at 80 per cent. efficiency is obtained.

SNYDER 53-STATION AUTOMATIC TRANSFER MACHINE

With the exception of fine-boring operations on the mainshaft, layshaft and reverse idler gear bores, which are carried out later, the remaining work on the gearbox casting, including drilling, reaming, spot-facing, chamfering, boring, tapping and milling, is completed on a Snyder (Gaston E. Marbaix, Ltd.), 53-station, in-line automatic transfer machine. From the second milling machine described above, the castings are placed on an inclined roller conveyor along which they travel

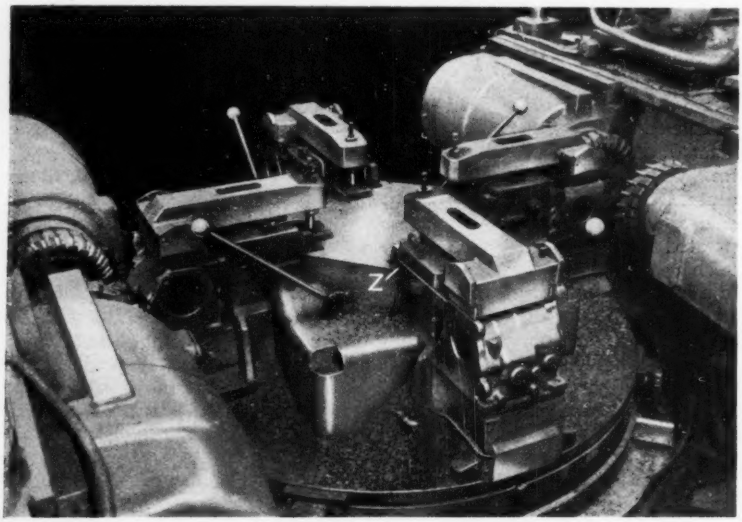


Fig. 10. Close-up View of the Table of the Machine for Milling the Gearbox End-faces, Showing Details of the Fixture and the Galtona Shear Blade Milling Cutters, of which Those at the Right are Employed for Finishing

to the entry end of the Snyder machine. A general view of the machine is given in Fig. 11, with the roller conveyor in the foreground. The machine, which has an overall length of 62 ft. and is approximately 21 ft. wide, will produce up to 80 castings per hour at 80 per cent efficiency, and is tended by only one man. It may be noted here that the entire gearbox line is tended by only four operators and two setters. An emergency stock of castings is maintained, in case of breakdown of the first two machines in the line. Normally, however, gearbox castings are taken from the roller conveyor and placed straight on the loading stage, which forms part of the transfer ways of the machine, as shown in Fig. 11. No pallets are employed, and the castings are loaded initially with their cover faces downwards and with their rear ends, having the larger mainshaft bore, leading. At each machining station, locating dowels enter the two 0·437-in. diameter holes in the cover face.

The machine is made up from 13 segments, with idle stations between, the segments comprising standard Snyder units, and each incorporates bases, with hardened and ground ways, carrying unit heads on each side of the clamping fixture bases. Because of the small size of the castings, most of the machining stations are combined in groups of two or three, each group of stations being served by a single unit head on either side of the transfer ways. The unit heads are hydraulically operated and electrically controlled, pressure oil being supplied by five self-contained pump and reservoir units at one side of the machine. Separate push-button controls are provided for each unit head, so that tool-changing is simplified, and pre-set tooling is employed.

Each segment has combination fixtures to suit the number of machining stations that it incorporates, and these fixtures take the form of cast bridges which straddle the ways of the transfer line. At each station, the bridge carries a hydraulic cylinder directly above the machining position, and the lower end of the vertical ram of the cylinder bears a universally-mounted pad, whereby the casting is clamped to the transfer ways. The cylinder rams extend above the bridge members and are fitted with cross-bars with forked ends, which engage vertical plungers accommodated in bores in the fixture castings. At their lower ends, these plungers are connected to short, centrally-pivoted levers, and the ends of the levers remote from the plungers are connected to the locating dowel pins mentioned earlier. When oil is supplied above the piston in each clamping cylinder, the ram is moved down, so that the other plungers are lowered, and the locating dowels are raised to engage the holes in the casting. Further downward movement of the ram brings the clamping pad into contact with the top surface of the casting, and it is then locked in place by a wedge that is advanced by a horizontal cylinder at one side. The final portion of the movement of the ram operates a limit switch, and the circuit thus

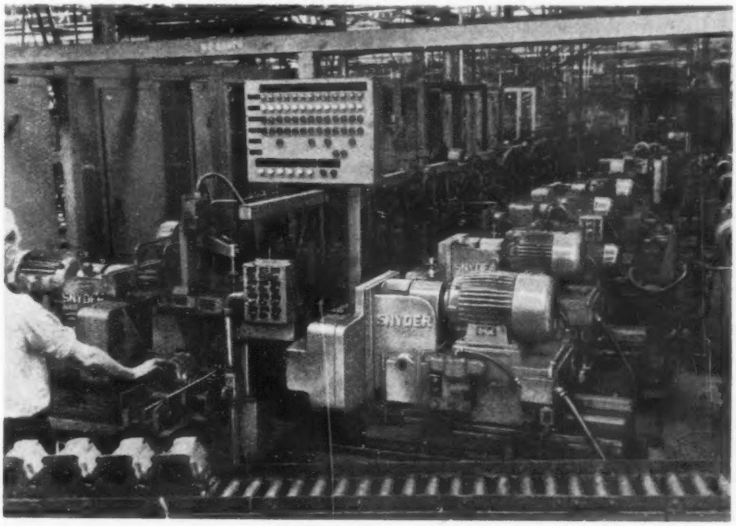


Fig. 11. General View, from the Loading End, of the Snyder 53-station Automatic Transfer Machine for Victor Gearboxes. This Machine is 62 ft. long and 21 ft. wide, and will Produce up to 80 Castings per Hour at 80 per cent Efficiency

completed controls the next stage of the automatic cycle. All the castings must be located and clamped, and all the circuits closed, before the machining heads start to move in.

The unit heads of each segment are equipped with multi-spindle drilling or milling attachments designed specifically for the operations to be performed at the machining stations of that segment. Where necessary, however, a unit head on one side of the machine may serve merely to advance support bushes for boring or other tools which are employed for operations on the opposite side of the gearbox casting that is machined at that station.

TRANSFER MACHINE OPERATIONS

The various operations that are carried out on the machine may be divided into three groups, the first group being performed with the rear end-face of the casting leading. For the second group, the casting is turned so that the rear end-face is to the right (viewed from the loading end), and, for the third group, the casting is turned so that it rests on its front end-face, with the cover face to the right of the machine, as will be seen later. Transfer of the castings is effected by a conventional bar, with spring-loaded dogs, the bar being moved by a single hydraulic cylinder after all the castings have been clamped. Machining is carried out dry, and beneath the transfer-ways is a conveyor which discharges swarf at the further end of the machine by means of a swan-neck, into a large box pallet.

As already noted, the casting passes through the first 12 machining stations resting on its cover face and with the rear end-face leading. Loading is carried out at station 1, and at station 2, three holes of 0·257 in. diameter (later to be tapped $\frac{5}{16}$ in. by 18 U.N.C.) and one hole of ½ in. diameter are drilled in both sides of the casting. The ½-in. hole corresponds to the bore *K*, Fig. 3, which accommodates the striking-lever cross-shaft and material is thus left for subsequent finish reaming. It may be observed that the gearbox is of approximately symmetrical form to allow for the building of cars with left- or right-hand drive. In addition to the holes mentioned, a filler-plug hole is drilled by the unit head on the right. At station 3, the bosses round the 0·257- and ½-in. holes are spot-faced, and the cross-shaft hole is rough counter-bored on both sides of the casting. The cross-shaft hole is spot-faced and chamfered, also on both sides, at station 4. These last three stations are combined to form one of the machine segments.

Station 5 is idle, and, at station 6, the three holes referred to above are chamfered, while the cross-shaft hole is semi-finish counter-bored. For counter-boring, a cutter of 1 in. nominal diameter is used, with four carbide-tipped teeth, and is run at 420 r.p.m. These operations are carried out on both sides of the casting, and, at the same time, the filler plug hole is countersunk by a cutter in the right-hand head. At station 7, the cross-shaft hole is finish-reamed to 0·5118/0·5129 in. diameter, and, at station 8, the cross-shaft counter-bore is finished to 1·000/0·999 in. diameter on both sides of the casting. Stations 6, 7, and 8 form another segment of the machine.

An idle station (No. 9) follows, and, at station 10, probes are advanced into the holes which are

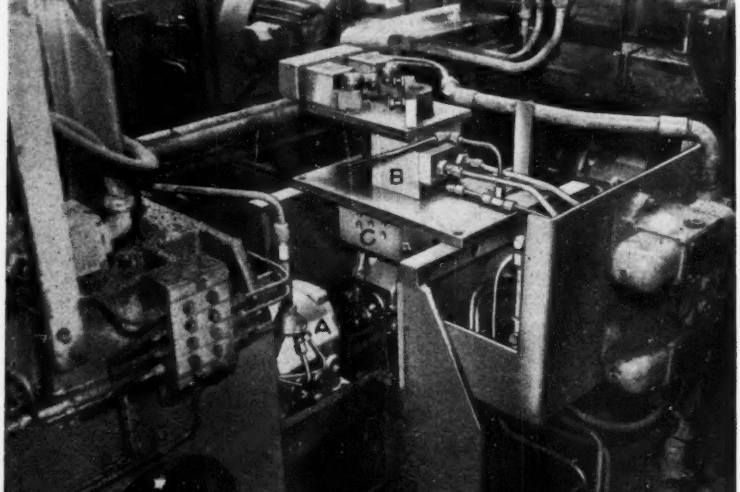


Fig. 12. Between the First and Second Sections of the Snyder Transfer Machine is this Re-orientating Station (Number 13), Where the Casting is Raised into Engagement with the Channel *C* and Indexed Through 90 deg. for Operations on the End Faces

to be tapped, to ensure that they have been drilled right through. Station 11 is equipped for tapping three holes $\frac{5}{16}$ in. by 18 U.N.C. on both side faces, also one ½-in. by 14 A.N.S.P. hole for the filler plug on the right-hand side. An important feature of this and the other tapping heads on the Snyder machine is that they are all arranged for feeding under lead-screw control. For the small holes, the taps are run at 182 r.p.m., and for the large one at 74 r.p.m. A feed rate of 8·5 in. per min. is employed, and the large tap is flexibly mounted, in order that it can move longitudinally to compensate for the difference in the pitches of the two threads. The speeds of most of the drill spindles in this and other sections of the machine is selected to give a peripheral speed of approximately 60 ft. per min. Reaming is carried out at 30 ft. per min., spot-facing and counterboring at 80 ft. per min., and tapping at 15 ft. per min. Stations 9, 10 and 11 form the third machine segment, and station 12 is idle.

In the second section of the machine, operations are carried out on the end faces of the casting. Before it enters the section, the workpiece is turned through 90 deg. in a horizontal plane, so that the rear face (which was leading) is at the right, and the location holes in the cover face are towards the loading position. Indexing takes place at station 13, and a view of the mechanism employed is given in Fig. 12, looking from the right-hand side of the machine, with station 11 at the extreme left. The casting *A* is at the adjoining idle station (12), and to the right of this station is the indexing station No. 13, with a casting turned to the position required for the succeeding stages.

When the casting is advanced from the idle station 12 to the indexing station, it is thrust on to a portion of the transfer track that can be moved vertically by means of a hydraulic cylinder below it. A flat plate, supported by side members above the track, carries a square-section block *B* on its upper surface. Secured to the top of the block is another plate, on the face of which are mounted two lever-action micro-switches. A spindle passes through a vertical bore in the block *B* and the diameter of the spindle is such that there is clearance between it and the walls of the bore. Two vanes of plastics material on the spindle are accommodated in this clearance space, and the vanes are set at 180 deg. apart. Similar vanes project from the block into the bore, and the spindle is turned when pressure-oil is admitted on one side of the vanes. By directing the oil flow to the other side of the vanes, the spindle is turned in the opposite direction. A cross-bar is secured to the upper end of the spindle and has adjustable stops which actuate the limit switches, and thus reset solenoid-operated valves, whereby the oil-flow is stopped, or its direction reversed.

An inverted channel-section steel bar *C*, on the lower end of the spindle, is machined to fit the curved top of the gearbox casting. When it is turned through 90 deg. from the position shown, the channel is aligned with the transfer ways of the machine. A transfer movement of the machine then brings the casting at *A* into a position directly beneath the channel *C*, whereupon the movable portion of the transfer track is raised, and the top of the casting is engaged in the channel. Pressure oil is then directed to the appropriate side of the vanes to turn the spindle in the block *B* so that the casting is indexed into the position shown. The movable portion of the track is then lowered, to position the casting at the correct height for the next transfer movement. Finally, the direction of the oil supply to the block *B* is again reversed, to re-align the channel with the transfer-ways, in readiness for the next indexing operation.

The indexing station is followed by an idle position, and the first machining station of the second section of the machine is just visible at the extreme right in Fig. 12. This station (No. 15) occupies one segment of the machine and is employed for rough-boring and chamfering the large and small main-shaft bores. Cutters with 4 carbide-tipped blades are used, and each is fitted with an extra chamfering tool-bit. A spindle speed of 250 r.p.m. is adopted for the smaller bore in the front face, on the left-hand side of the machine, and for the larger bore, on the right-hand side, the speed is 200 r.p.m. These speeds provide a surface speed of about 200 ft. per min., and the feed rate of each spindle is 0·020 in. per rev. Originally, Wesson tools were supplied for this and similar work on the Snyder machine, but as they become unserviceable they are being replaced with Galtona (Richard Lloyd, Ltd.) inserted-blade cutters.

A view from the left-hand side of the machine, directed slightly towards the loading end (at the right), is given in Fig. 13, and shows station 15 at the extreme right, with the single clamping unit above it. To the left of this position are two idle stations (No. 16 and 17), and at the centre of the illustration may be seen the segment containing stations 18 and 19, with another idle station, No. 20, at the left. The cross-bars which move the vertical plungers are seen at *D*, but since the locating holes are now in the trailing edges of the casting, the lever arrangements differ somewhat to those mentioned earlier, but the method of operation is generally similar. The two horizontal cylinders which advance the wedge-locking mechanisms are indicated at *E*, and the control panel for the head is visible in the right fore-

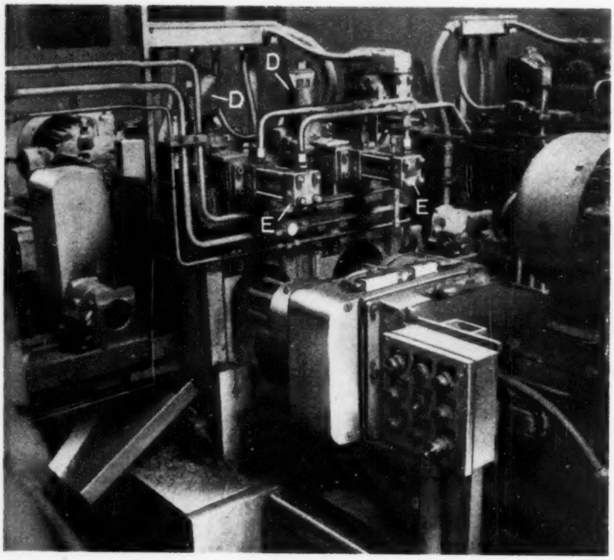


Fig. 13. In this View of the Fifth Machine Segment, Comprising Stations 18 and 19, the Cross-bars, Attached to the Clamping Cylinder Ram, for Lowering and Raising the Locating Dowels are Seen at *D* and the Wedge-lock Operating Cylinders at *E*

ground. A sheet metal chute, whereby swarf is led down to the under-floor conveyor, may also be seen.

At station 18, the left-hand head is employed to drill one $\frac{1}{4}$-in. diameter hole and five 0·203-in. diameter holes, that are later tapped $\frac{1}{4}$ in. by 20 U.N.C. At the same time, the right-hand head drills five holes of 0·316 in. diameter for tapping $\frac{3}{8}$ in. by 16 U.N.C. The left-hand head at station 19 chamfers the tapping-size holes drilled at the previous station. In addition, it is employed for drilling a $\frac{1}{4}$-in. diameter drain hole part-way through the casting, in a position in which it will break into the side of the layshaft bore in the front face of the gearbox. The head on the right at this station provides for rough-drilling the reverse idler shaft bore (*J*, Fig. 3) to $\frac{11}{16}$ in. diameter, and the first and reverse gear striking rod clearance hole (*H*, Fig. 3) to $\frac{33}{64}$ in. diameter.

The next two stations are idle, and stations 22 and 23 form another segment of the machine. At station 22, the left-hand head is employed to produce a number of holes in the front face of the casting. Two holes, of 0·469 in. diameter are drilled near the top of the mounting flange and two of 0·368 in. in ears on each side of the front face, for later tapping $\frac{7}{16}$ in. by 14 U.N.C. The second and third speed striking-rod bore (*G*, Fig. 3) is rough-drilled $\frac{9}{16}$ in. diameter, and the layshaft bore (*F*, Fig. 3) is drilled $\frac{5}{8}$ in. diameter. For most of the drilling operations, a spindle speed of 394 r.p.m., and a feed-rate of 0·012 in. per rev. are employed.

The right-hand head at station 22 drills a $\frac{47}{64}$ in. diameter hole for the reverse idler shaft through a lug within the casting, as shown in the part-section Z-Z, Fig. 3. It also provides for drilling one $\frac{15}{32}$-in. diameter hole, and for centre-drilling one hole in the rear face of the casting, in addition to drilling the rear end of the layshaft bore $\frac{5}{8}$ in. diameter. The speeds and feeds employed are similar to those for the left-hand head. Most of the holes mentioned are chamfered by tools in the heads at both sides at station 23. Here, a spindle in the right-hand head is also equipped to drill a $\frac{35}{64}$-in. diameter hole, for the first and reverse speed striking rod, through a lug within the casting, adjacent to the rear wall. This lug may be seen at the upper left in section *Y-Y*, Fig. 3.

Stations 24 and 25 are again idle, and both heads at station 26 carry reamers to rough-machine the layshaft bores in the front and rear faces of the casting to 0·646 in. diameter. At the same time a tool in the left-hand head drills a $\frac{9}{16}$-diameter hole for the first and reverse speed striking rod through a lug within the casting, adjacent to the front wall. A line-reamer in the right-hand head also semi-finishes the reverse idler gear shaft bores to 0·764 in. diameter. Station 27 is combined with station 26, and the left-hand head carries probes which enter a total of seven holes to ensure that they are clear for tapping. The right-hand head has five spindles with tools for chamfering holes so that the taps employed later in the sequence will enter more easily. Station 28 is idle.

In Fig. 14 is shown a view of the next machine segment which combines stations 29, 30 and 31, looking towards the loading end of the machine, with the right-hand head of the line in the foreground. This head is employed solely to position guide bushes in internal recesses within the gearbox castings to facilitate drilling and reaming operations that are carried out by the three heads on the further, left-hand side of the machine. For this purpose, the right-hand head has three cylindrical members *F*, attached to brackets on the body of

the head, which is advanced into the machining position by hydraulic power, in the normal manner. On top of the head body are two double push-bars, connected by a yoke to the ram of the small hydraulic cylinder at the left. The push bars are engaged by a flange on the end of a cylindrical bar which projects towards the rear from the bore in each of the cylindrical members *F*. Within each member *F*, the bar is connected to a cam-type mechanism whereby a short bush-holder *G* may be advanced outwards or retracted. In Fig. 14, these bush-holders have been advanced artificially with the head in the retracted position, in order that they may be seen more clearly. The operations performed by this segment of the Snyder machine require the longest cycle time, and control the output of the entire unit. A period of 0·14 min. (8·4 sec.) is needed to move the bushes into place and subsequently retract them, in addition to the normal machining time.

Other details, visible in Fig. 14, include the cross-bars attached to the clamping cylinder rams above the fixtures, for the operation of the locating pin plungers, and the limit switches whereby the machine sequence is interlocked. Stations 26 and 27 may also be seen at the left. The left-hand head of station 29, on the further side of the clamping fixture in Fig. 14, is employed for drilling a $\frac{35}{64}$-in. diameter hole, for the second and third speed striking rod, through a boss on the inside of the front wall of the casting, and for enlarging the clearance hole in the front wall through which the first and reverse speed striking rod is later inserted. Station 30 is employed for rough line-reaming the first and reverse, also the second and third speed, striking rod bores. The stepped reamers used are run at 198 r.p.m., and are fed at 4·3 in. per min.

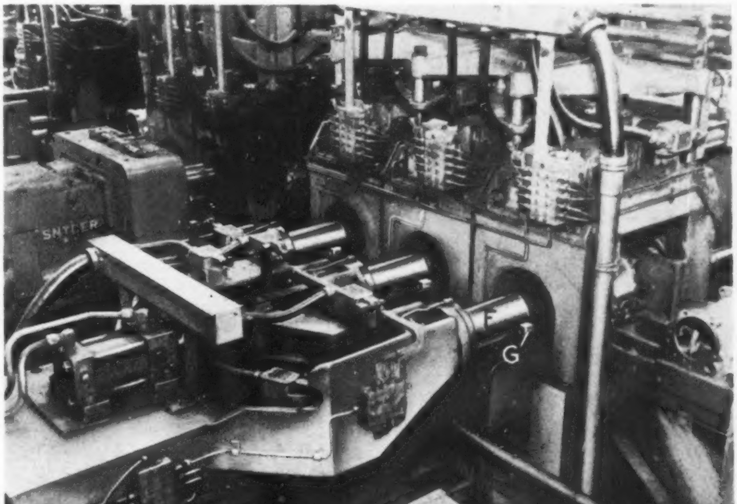


Fig. 14. The Right-hand Head of the Eighth Segment, which Includes Stations 29, 30 and 31, is Employed Solely to Carry Support Bushes *G*, Here Seen Advanced Artificially, for the Tools in the Head on the Opposite Side of the Machine

These bores are finish line-reamed at station 31, and similar speed and feed rates are adopted.

Two idle stations follow, before the next machine segment, and in this latter segment are combined stations 34, 35 and 36. Station 34 is employed for semi-finishing the mainshaft bores at each end of the casting. Four-bladed cutters are again employed, and the blades from these cutters are used for the roughing operations when they become too worn to permit further re-sharpening. The right-hand head at station 35 carries probes for checking five of the holes that are to be tapped. Tapping is performed at station 36, and two holes $\frac{7}{16}$ in. by 14 U.N.C. 2B, and five holes $\frac{1}{4}$ in. by 20 U.N.C. 2B, in the front face, and five holes $\frac{3}{8}$ in. by 16 U.N.C. 2B, in the rear face, are tapped by the left- and right-hand heads respectively. Tapping completes the series of operations on the end faces of the gearbox, which, after passing through an idle station, then enters the third section of the machine.

TURN-OVER UNIT

From the idle station mentioned, castings pass to station 38, where they are turned over so that each rests on its front end-face, with the cover face to the right-hand side of the machine. A view of this station, from the left-hand side of the machine, is given in Fig. 15, and shows the casting in the process of being turned on to its front end-face from its original setting, with its cover face downwards. The mechanism incorporates vertical and horizontal hydraulic cylinders, and the latter unit

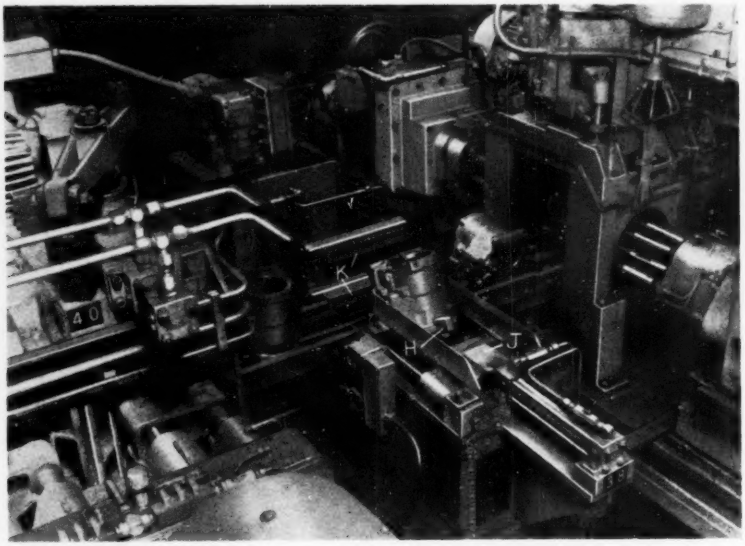


Fig. 15. At this Turn-over Station (Number 38), Between the Second and Third Sections of the Machine, the Casting is Turned Through 90 deg. in a Vertical Plane so that it Rests on its Front Face

is seen in the right foreground. The end of the piston rod of the vertical cylinder is connected to a pivoted member, one end of which is just visible in Fig. 15, and is indicated at *H*. At the start of the turnover sequence, the member *H*, which has a hook at its upper end, occupies a vertical position. The transfer motion of the machine carries the next casting to such a position that the mounting flange at the front end is located beneath the hook. When the next machining cycle commences, pressure-oil is directed to the vertical cylinder of the turnover mechanism, so that the member *H* is turned on its pivot, which is below the level of the transfer track. In consequence, the casting is pulled over, as shown, and rests on guide rails with its front end-face lowermost and its cover face vertical.

Oil is then delivered to the outer end of the horizontal cylinder, and the carriage *J* is moved forwards, carrying the casting towards the transfer track, until its cover face makes contact with vertical surfaces *K*. The ram of the horizontal cylinder is then retracted, returning the carriage *J* to the position shown, before the hooked member *H* is raised by the vertical cylinder ready for the next transfer movement of the machine.

An idle station, number 39, follows the turn-over station, and the casting then moves to station 40, which is combined with station 41 in the next machine segment. A view of this segment from the right-hand side of the machine, looking towards the loading end, is given in Fig. 16, and the turn-over station may just be seen beyond it at the left.

Heads on the left-hand side of the machine are employed for operations on bosses on the semi-cylindrical top-surface of the casting, and those on the right-hand side provide for internal milling and for chamfering the cover face holes. Because the cover face is now in the vertical plane, the locating dowel pins must be moved horizontally to engage the casting. One end of each cross-bar for the operation of a dowel pin is, therefore, anchored in a slotted pillar on the far side of each fixture top-member, so that a single plunger attached to the nearer end of the bar is lowered and raised to operate the pins.

Two holes of 0·368 in. diameter by 1 in. deep (for tapping $\frac{7}{16}$ in. by 14 U.N.C.) are drilled in bosses on the outside of the casting by the left-hand head at station 40. The tooling for the head at the right-hand side of the segment is seen in Fig. 16, and consists of a special adaptor with vertical spindles at stations 40 and 41, which carry a roughing and a finishing milling cutter respectively. These cutters are applied to machine the inner face surrounding the layshaft and reverse idler bores at the rear end of the casting (seen uppermost in Fig. 16), also one face of the reverse idler lug, to the dimension shown in the part-section Z-Z, Fig. 3. For these operations, cutters of 4·56 in. diameter are used, and each has 10 carbide-tipped serrated blades. The roughing cutter is 1·44 in. wide and the finishing cutter 1·501 in. wide, and the tools are arranged to cut on both the top and bottom faces. For roughing, a spindle speed of 167 r.p.m. is employed, giving a peripheral speed of about 200 ft. per min., and for finishing the speed is 184 r.p.m., the feed rate for both operations being 8·5 in. per min. Since

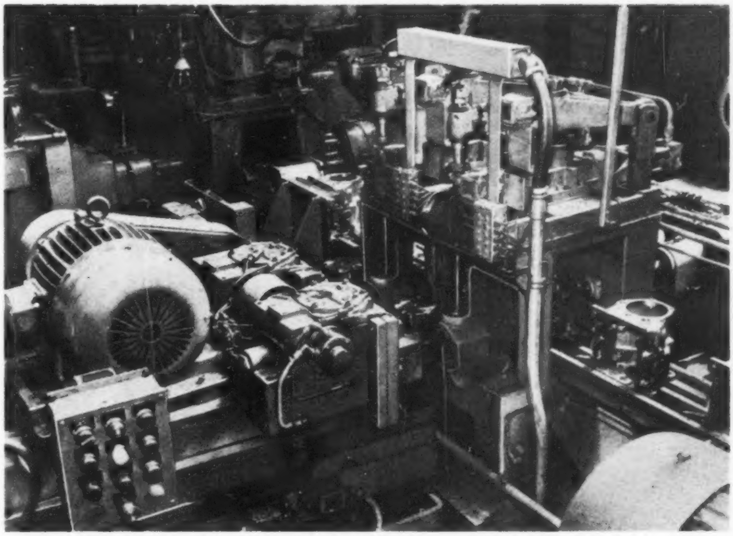


Fig. 16. At the Tenth Machine Segment, Incorporating Stations 40 and 41, the Right-hand Head is Fitted with a Two-spindle Milling Attachment for Rough- and Finish-milling Operations on Internal Surfaces of the Casting

the dimension between the machined faces must be accurately maintained, the cutters are provided with blades which are retained in their slots by a wedging action, grub-screws being provided for adjustment and clamping.

The holes machined at station 40 are drilled right through by the left-hand head at station 41, so that they communicate with the two striking rod bores. Stations 42 and 43 are idle, and at station 44, special carbide-tipped, 4-bladed cutters in the left-hand head are applied to spot-face and chamfer the holes drilled at the previous stations. Station 44 and station 45 form one segment of the machine, and the left-hand head at station 45 provides for reaming the lower ends of the same pair of holes to 0·3166/0·3180 in. These holes are subsequently employed to accommodate locking plungers for the striking rods, as seen in the cut-away view, Fig. 1. The right-hand head serving stations 44 and 45 is arranged in a somewhat similar manner to the unit shown in Fig. 16. In this instance, however, the cutters are carried at the lower end of each vertical spindle, and machine the inner face surrounding the lay-shaft bore at the front (lowermost in Fig. 16) end of the casting. Facing cutters of 4 in. diameter are employed, which are run at 190 r.p.m. for roughing, and at 239 r.p.m. for finishing. Both spindles

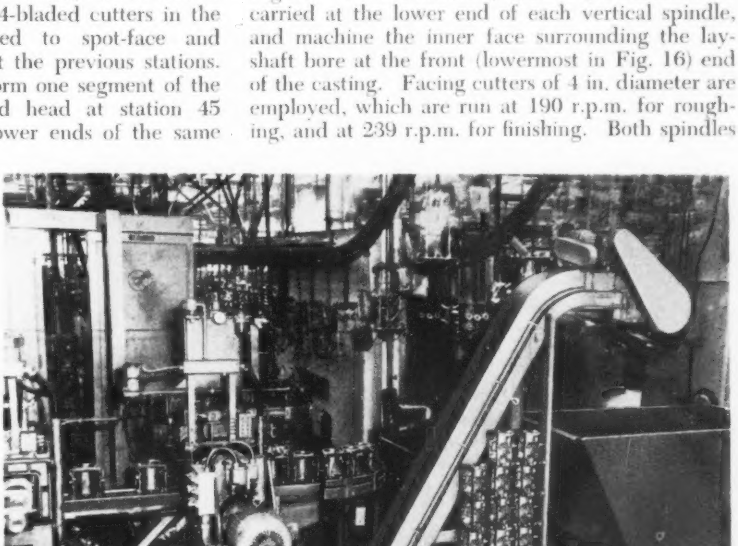


Fig. 17. Station 52 Provides for Tapping the Cover Face Holes and Milling the Rear Face of the Mounting Flange at the Front of the Casting. Swarf Carried from each Machining Station by a Slat-type Conveyor, is Discharged by the Swan-neck End into a Large Box-pallet

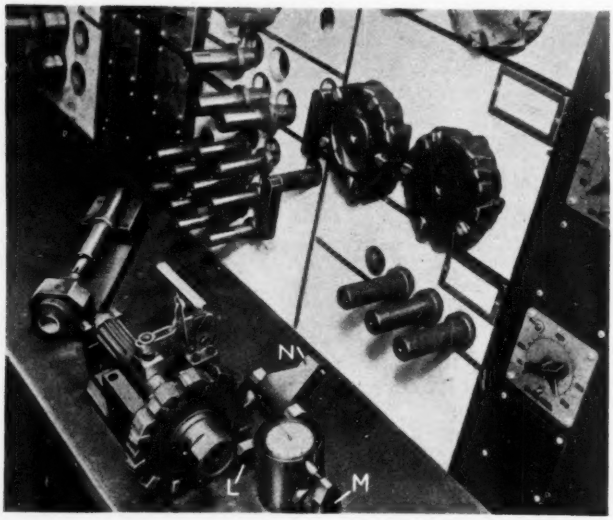


Fig. 18. Close-up View of One of the Four " Royal " Tool Control Boards, Showing the Dials on which Successive Machine Cycles are Registered and One of the Fixtures Whereby a Milling Cutter can be Pre-set After Sharpening

are advanced at a feed-rate of 5·8 in. per min.

Stations 46 and 47 are idle, and the left-hand head at station 48 provides for tapping a $\frac{7}{16}$ in. by 14 U.N.C. 2B thread in each of the two holes in the bosses on the semi-cylindrical outer surface of the casting. Tools fitted in the right-hand head at this station chamfer the 10 cover face holes in readiness for tapping, and, at station 49, these holes are probed to ensure that they may safely be tapped. Stations 48 and 49 are combined in one segment, and the left-hand head of station 49 is idle, as are stations 50 and 51. The final stations of the machine may be seen at the left, in Fig. 17, which is a view of the unloading end of the machine, showing the swan neck of the conveyor whereby swarf is discharged into large box pallets. Station 52 occupies a single segment of the machine, and the head on the right-hand (nearer) side is employed to tap the 10 holes in the cover face $\frac{1}{4}$ in. by 20 U.N.C. 2B. A 2-spindle milling attachment on the left-hand head at this station carries two cutters of 5·82 in. diameter, each with 12 inserted teeth, which are plunge-fed to machine the rear of the mounting flange at the front end of the casting. The cutters are run at 144 r.p.m., and are fed at 12·5 in. per min. From this station, the casting is moved by successive transfer motions to station 53, which is idle, and along a short curved length of roller track, until it passes on to a set of curved guide rails on the further side of the machine, as viewed in Fig. 17.

These guide rails are inclined and twisted so that, as each casting slides downwards under gravity, it is automatically turned through 90 deg. and eventually is positioned with its cover face downwards. From the rails, the castings pass on to a short power-driven slat conveyor whereby they are raised and deposited on the end of an inclined roller conveyor which carries them to the entry end of a washing machine.

TOOLING ARRANGEMENTS

Before going on to describe the remaining operations on the casting, it is proposed to discuss briefly the tooling equipment for the transfer machine. As mentioned earlier, all the spindles of the machine are arranged so that they will accept pre-set tooling, and four tool control boards are provided to facilitate tool maintenance. All the control boards were supplied by Royal Designs & Manufacturing, Inc., Centerline, Michigan, U.S.A., and a close-up view of a typical unit is given in Fig. 18. The boards are of conventional American design, and each has storage space for two sets of tools so that, when one set is away for re-sharpening, there is a spare set available for use in an emergency. At the right-hand side of each storage position, on the near-vertical board, is a label giving details of the station where the tools in that position are used, and reference numbers of the tools, their bushings and the setting gauge employed. Beside each tool-storage position is a counter unit, termed a Cy-Co-Trol. As shown at the extreme right in Fig. 18, each Cy-Co-Trol unit has an adjustable indicating pointer and a knob which can be turned by hand. The dial of the counter is graduated and marked with numbers up to 9,000. Each tool-control board is connected to the appropriate portion of the transfer machine, and, at each machine cycle, the knob is turned slightly in an anti-clockwise direction towards the zero position.

Tool life for each station is calculated or estimated from prevous experience, and the indicating pointer is set to this number of cycles on the dial. When the tools are changed, the knob is aligned with the pointer, and it then indicates continuously the number of cycles that remain before the tool or set of tools concerned must be changed. The

machine operates until the knob reaches the zero position. Then, an electrical interlock inside the board is broken, the machine is stopped and an indicating lamp is illuminated to inform the setter that the tools on that particular head require attention. After a setter has tended one machine for several months, he becomes conversant with the sequence in which the tools require attention, and is often able to suggest changes to the cutting speeds or feeds so that several tools may have a similar life and can be changed together, thus minimizing non-productive time.

Two of the fixtures employed for pre-setting tools are shown on the bench in front of the control board in Fig. 18. Most of the cutter arbors have some form of lock-nut or collar whereby the tool can be set with its cutting edge at a precise distance from a flange. The flange is then pulled up against a datum surface on the machine spindle. The fixture in the foreground is employed for setting one of the 5·82-in. diameter cutters, from station 52 of the transfer machine, on its driving arbor, which is provided with a splined end. The cutter, on its arbor, is held in V-blocks, with the adjustable collar at the far end of the arbor in contact with a datum face. A finger *L*, on the end of a horizontal plunger is then moved into contact with the side cutting face of a tooth, and a projection *M*, on the other end of the plunger, then depresses the stylus of a dial gauge, which indicates the position of the side cutting edge relative to the collar face. The dial indicator is set at zero with the aid of the swinging stop *N*.

From the transfer machine, gearbox castings are carried, by the roller-conveyor mentioned earlier to a washing machine. They are passed through the latter unit automatically and are delivered on to another length of roller track which serves as a buffer store, to provide for a breakdown of one of the machines. From the storage conveyor, the castings are loaded on to the Ex-Cell-O duplex fine-boring machine shown in Fig. 19. This machine has 10 spindles and is arranged to perform boring operations on two castings simultaneously. Automatic unloading equipment has been designed for the Ex-Cell-O machine, but, at the time that the photograph was taken, this equipment had not been installed, and a fixture arranged for manual loading and unloading was in use. Loading is readily performed, and the castings are placed on the fixture base so that dowels, projecting upwards from the base, engage the location holes in the cover face. A beam, hinged at the rear of the base, carries a clamping bar assembly, which is arranged to compensate for any slight differences between the castings of a pair. Pressure is applied to the bosses on the curved outside face of the casting by pegs that project downwards from rocker-members, and the beam is clamped by means of a swinging stud and star-nut at the front of the fixture.

The table carrying the fixture is moved first to the left and then to the right for the successive boring operations. Spindles in the head at the left are provided with tools to finish the small bore for the mainshaft in the front face of each casting to 3·060/3·061 in., and the layshaft bore at that end to 0·7035/0·7041 in. diameter. When the table is traversed to the right, spindles at that end of the machine provide for finishing the large

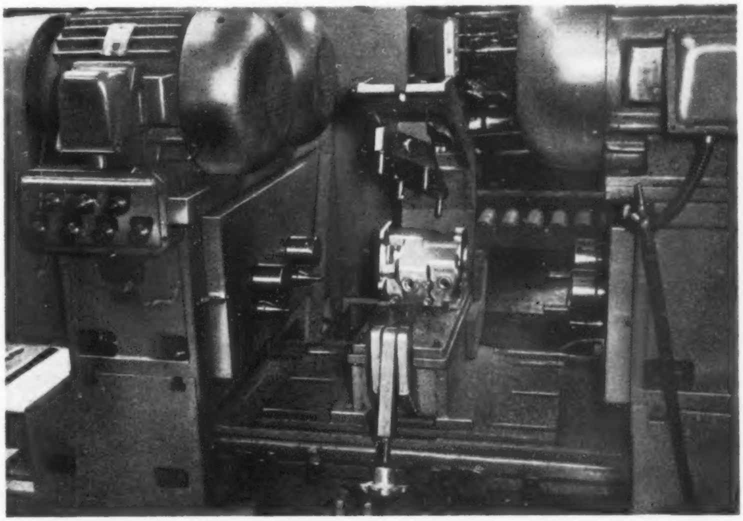


Fig. 19. On this Ex-Cell-O Fine-boring Machine, the Bores for the Mainshaft, Layshaft and Reverse Idler Gear Shaft are Finished on Two Castings Simultaneously, the Table Being Fed Towards Each Set of Spindles in Succession

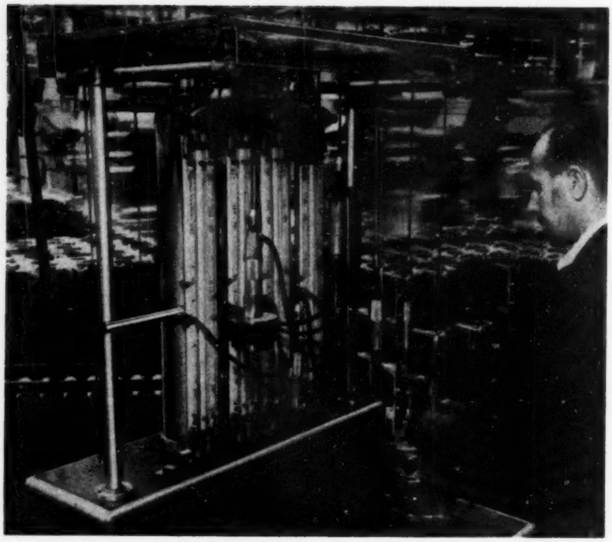


Fig. 20. Inspection of the More Important Bores of the Gearbox Casting is Carried Out by the Operator of the Fine-boring Machine with this Solex Equipment

mainshaft bore of each casting to 3·905/3·906 in., the layshaft bore to 0·6693/0·6699 in., and the two steps of the reverse idler shaft bore to 0·7795/0·7803 and 0·7995/0·8004 in. diameter. The machine cycle is entirely automatically controlled, and the spindles are run to provide a surface speed of 264 to 360 ft. per min., and the table feed rate is 1½ in. per min.

After machining has been completed, the more important dimensions of the casting are inspected, on a 100 per cent basis, by the operator of the fine-boring machine with the aid of the equipment shown in Fig. 20. This equipment consists of a bench with rails, whereon the casting can travel easily, and there are four standard Solex pneumatic gauging units at the rear. The gauge heads are suspended from overhead pulleys and are counterbalanced to reduce operator fatigue. First, each casting is placed on the rails with its front end uppermost, and is moved along so that the heads may be inserted manually into the various bores in turn. The first three positions provide for inspecting the small mainshaft bore, the layshaft bore, and both the change speed striker shaft bores. Then, the casting is inverted, and the reverse idler shaft bore, the other layshaft bore and the large mainshaft bore are checked.

Castings within the inspection limits are placed on the hangers of an adjacent overhead conveyor. This conveyor is fed with other gearbox parts from adjoining working areas, and carries the components through another washing machine and, finally, to the gearbox assembly track. In the next article in this series, details will be given of the more interesting methods employed in the manufacture of such gearbox components as front and rear covers, striking levers and forks, mainshafts and clutch hubs.

Molytox Plus Molybdenized Lubricant, which has now been introduced by Rocol, Ltd., Rocol House, Swillington, Leeds, is stated to produce a film which has more than 15 times the wear resistance of that obtained with the original Molytox. The latter, it may be noted, is still being retained for quantity production and light lubrication applications. Much of the improvement, it is stated, is due to careful matching of particle sizes of the solid content, and more care is necessary in applying the new product. The purposes for which it is recommended include pre-treatment of plain bearing and sliding surfaces, gear teeth, cutting tools, dies, and lightly-loaded ball and roller bearings. It can be applied to both metallic and non-metallic surfaces by brushing, spraying, or dipping, and the films will withstand normal handling and provide considerable protection against corrosion.

Marking Tape for Factory Gangways. A new type of pressure-sensitive vinyl plastics tape, known as Scotch Boy No. 471 lane marking tape, has been introduced by the Minnesota Mining & Manufacturing Co., Ltd., 3M House, Wigmore Street, London, W.1. It is intended for marking out gangways, aisles, and parking areas, also for warning lines on factory and warehouse floors, and it is stated that it can be quickly and easily laid on almost any clean, dry, hard surface, including a concrete floor. White in colour, it can be supplied in 36-yard rolls; in widths from ½ to 4 in. When in position, the tape is resistant to oil, water, caustics, acids, and most commercial solvents. From the results of tests, it is reported that the life of the tape is several times that of a painted line, so that there is a saving of some 40 per cent in the annual cost for a given length of line,

The Production of Ball and Roller Bearings

Methods Employed by the Hoffmann Manufacturing Co., Ltd.

In an earlier article in MACHINERY, 92/640—21/3/58, reference was made to some of the methods employed by the Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, for producing various types of cages for their wide range of ball and roller bearings. The set-ups described included some typical examples from the "press" and "solids" sections of the cage shop, which are concerned, respectively, with pressed and machined cages. Here, some further aspects of the production of machined cages are considered.

As already indicated, the machining of ball and roller pockets in cage-rings is performed principally on special-purpose machines in various capacities up to 25 in. diameter. For larger rings, and certain special work, there is a group of Archdale heavy-duty drilling machines, which are employed for machining pockets in ball cages up to 28 in. diameter, and roller cages up to 30 in. diameter. A typical set-up, for machining 24 roller pockets, of 1·259/1·260 in. diameter by 1·260/1·263 in. deep, in 14¾-in. diameter brass cage-rings, is shown in Fig. 1. The work is located by a spigot-plate on an indexing table of the company's own design, and is clamped by means of a circular drilled plate, secured by a single central screw.

Fig. 1. Typical Set-up on an Archdale Heavy-duty Drilling Machine, for Machining Axial Roller Pockets in Large Cage Rings up to 30 in. Diameter

The table is indexed manually, by means of a lever. This lever projects from a ring which is coupled to the table and index-plate through a friction clutch, and the clutch disengages automatically when the ring is rotated in an anti-clockwise direction. Attached to the ring at a point diametrically opposite the hand-lever, there is a cam, which engages the roller *A*, when the ring is rotated. This roller is mounted on a small slide that carries the index locking plunger. To index the table, the hand-lever is pushed forward until a peg *B*, on the edge of the ring, engages a stop-pin *C*, and, in this position, the roller *A* is displaced by the cam so that the index locking plunger is withdrawn. When the lever is moved in the opposite direction, to rotate the table, the cam moves clear of the roller, and the plunger is returned by spring pressure to engage the next slot in the index-plate. At the set-up shown, the spade-type cutter is run at 845 r.p.m., and the feed is 7 in. per min.

BORING SQUARE HOLES

Certain of the roller cages produced are of a one-piece type, in which the square holes for the rollers are machined radially. The holes are usually drilled at one of the radial set-ups earlier described, and subsequently broached. Some of these cages are of small diameter in relation to the size of the holes, of which there is an odd number. Broach-travel is therefore limited, and a considerable number of broaching passes, with short broaches, may be necessary. In order to reduce the number of broaching stages, the company have recently adopted the practice of machining the holes square, with an Armag profile-boring head (Machine Shop Equipment, Ltd.), in preparation for broaching.

The profile-boring head is carried by the spindle of an Archdale 18-in. vertical milling machine, as shown in Fig. 2, and the work is mounted on a horizontal indexing head. The machine spindle,

it may be noted, is fitted with a Bellows air-hydraulic automatic feed unit. A bronze cage of $3\frac{1}{4}$ in. diameter, with a radial thickness of $\frac{5}{16}$ in., is machined with the set-up illustrated, and the eleven initially-circular holes of $\frac{3}{4}$ in. diameter, are opened out to within 0·010 in. of the finished size of $\frac{15}{16}$ in. in four passes. The head is run at 80 r.p.m., and a feed of 0·002 in. per rev. is employed. Normally, such a cage would require nine broaching passes per hole, but, by using the profile-boring technique described, the number is reduced to two.

A typical broaching set-up, on a 30-ton Hi-Ton hydraulic press, is shown in Fig. 3. The brass cage, of $2\frac{1}{2}$ in. diameter, has a radial thickness of $\frac{5}{16}$ in., and nine holes are broached, in two passes, to 0·601/0·609 in. square. For clamping and location, the arrangements are generally similar to those employed at the various radial pocket-machining set-ups described in the previous article. The work is held between a pair of spigoted register pads, one of which is mounted on a screw-type tailstock. Arranged to pivot on the fixed support for the rear pad, there is a locating finger A, which is swung downwards into engagement with the hole to be broached, and moved clear once the tailstock has been tightened. The first-stage broach has 10 teeth, with a rise of 0·002 in. per tooth (except on the last two) from 0·578 in. to 0·594 in. This stage is completed on each component in a floor-to-floor time of 1 min.

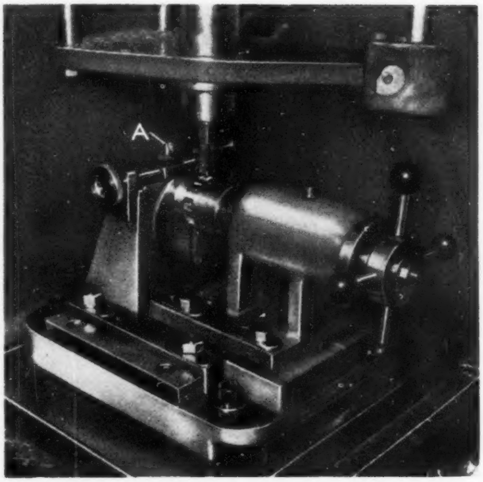


Fig. 3. At this Set-up on a 30-ton Hi-Ton Hydraulic Press, the Radial Roller Pockets are Broached in Two Passes, Using Short 10-tooth Broaches

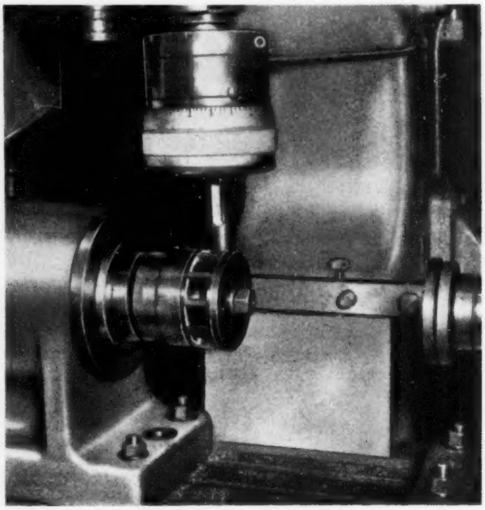


Fig. 2. An Armag Profile Boring Head, Set-up on an Archdale Vertical Milling Machine, is Employed for Machining Radial Roller Pockets Prior to Broaching, as Here Shown

DE-BURRING

Efficient de-burring of the machined cages is of great importance, and because of the quantity and diversity of the components handled, a number of problems is presented. It may be pointed out, in this connection, that in a single roller pocket, of the axial type, there are six separate edges to be de-burred—four parallel with the axis of the roller, and two where the bottom face of the pocket intersects the external and internal surfaces of the ring. The two latter edges, moreover, are curved. A large department is necessarily devoted entirely to de-burring, and, although mechanical devices are used wherever possible, a considerable amount of hand work is inevitably required, a high proportion of which is carried out by skilled girl operators.

In order to keep hand work to a minimum, extensive use is made of rotary burrs, which are usually set up on the spindles of vertical drilling machines. To avoid excessive metal removal, the teeth of these burrs are fine, and of an obtuse-angled form similar to those of knurling rolls. External corners of the pockets in radially-machined ball cages are de-burred with conical cutters, the operator holding the work against the

Fig. 4. De-burring Roller Pockets in a Large Cage Ring, by "Routing" the Sharp Corners with a Rotary Burr. The Four Corners are Removed from Each Pocket in 7 sec.

revolving cutter. The work is at the same time rolled sideways about the cutter, and allowed to slide between the fingers, so that, in effect, an "indexing" action is obtained. In this way, the pockets are presented to the cutter in rapid succession. The operators attain a high standard of skill, and can de-burr a cage of this type in a few seconds. Because of their inaccessibility to a power-driven cutter, however, the inner ends of the pockets, must be de-burred with hand tools.

A typical set-up for de-burring the pockets of a large roller cage ring, of the axial type, is shown in Fig. 4. As may be observed, the work is placed on a large flat table, and the four parallel corners of each pocket are fed against a cylindrical cutter. The cutter is set at such a depth that it just clears the bottoms of the pockets, and has a plain end-face. The technique employed is generally similar to routing, and each pocket, in a cage of the type shown, is de-burred in 7 sec. For the corresponding operations on the inner ends of the pockets, at the external surface of the ring, the work is set up on a 45-deg. angle-plate, mounted below a drill spindle, as shown in Fig. 5.

Each pocket, in turn, is located beneath the spindle, by engaging it with a register on the angle-plate, and the corner is lightly chamfered with a concave face cutter, which is run at 1,200 r.p.m. The cutter body is of plain cylindrical form and the depth of cut is controlled by means of the spindle depth-stop on the drilling machine. This particular cage has 12 pockets, which are de-burred in a floor-to-floor time of 30 sec. Generally similar methods are employed for de-burring the corners at the internal surface, except that the angle-plate is inclined in the opposite direction, a convex face cutter is employed, and the locating register is arranged to engage the pockets externally.

Special horizontal spindles, of the design shown in Fig. 6, are employed for de-burring double-row axially-machined ball cages for self-aligning bearings. The example seen is built up on a vertical drilling machine, the spindle of which is employed for steadying purposes only. An f.h.p. electric motor is mounted on a bracket attached to the left-hand side of the drill column, and drives the cutter spindle through a belt and pulleys, at 800 r.p.m. The cutter spindle bearings are carried in a rectangular frame mounted on the drill spindle, and the lower end of the frame can slide vertically between a pair of guide-blocks bolted to the table. The frame is held in the raised position by the return spring of the drill spindle.

A special profiled cutter is employed, which has the general form of a spool with outwardly-inclined flanges. In the centre, there is a smooth raised bead, of spherical form, which fits the pockets. On either side of this bead, there is a

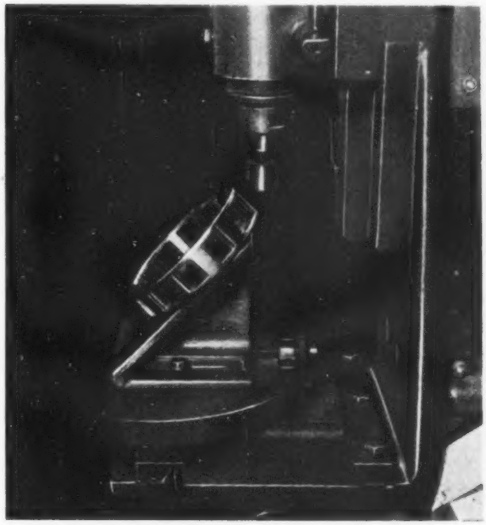


Fig. 5. Typical Set-up for De-burring the Bottom Corners of the Roller Pockets, at the External Diameter, with a Concave, Face-type, Rotary Burr

band of concave knurl-type teeth, the curvature of which blends into the inclined faces of the flanges. The work is supported at a short distance below the cutter on an auxiliary table, and each pocket in turn is aligned with the cutter. At each position, a pedal coupled to the lower end of the rectangular frame is depressed, so that cutter is plunged into the pocket, which is located by the centre bead. The corners on both the internal and external surfaces of the cage are thus chamfered simultaneously. When all the pockets on one side have been completed, the work is turned over, and the procedure is repeated. In this way, a cage such as that shown, with 13 pockets on each side, is de-burred in a floor-to-floor time of 10 sec.

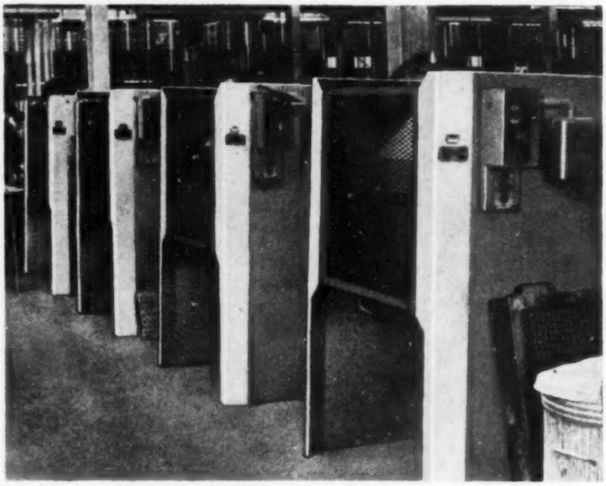


Fig. 7. Part of the Roto-finish Barrelling Section, where Machined Cages up to 6 in. Diameter are Finally Finished After being De-burred

ROTO-FINISHING

All de-burring on machined cages up to 6 in. diameter is carried out as a preliminary to a final barrelling treatment by the Roto-finish process. Larger cages cannot satisfactorily be finished by this method because of their greater individual weights, and the consequent risk of damage. The larger cages, therefore, are finished by other methods, such as wire brushing. In the barrelling section, there is a large number of Roto-finish machines, and a typical line is shown in Fig. 7. These machines are ranged on either side of a gangway, over which there is a gantry that serves both lines, and facilitates handling the charges.

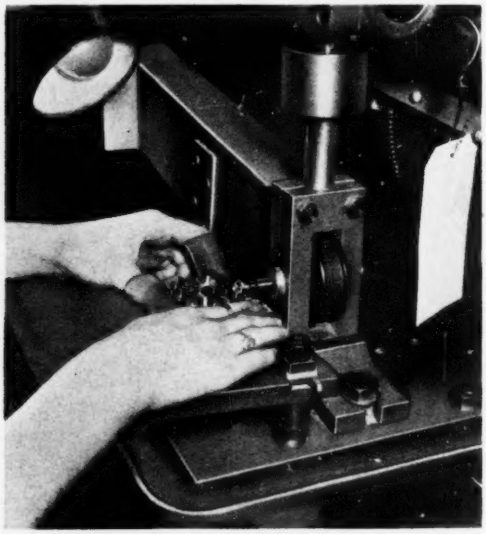


Fig. 6. With this Special-purpose Horizontal Spindle, a Skilled Operator Can De-burr a Double-row Ball Cage, with 13 Pockets per Side, in 10 sec.

In preparation for the Roto-finish treatment, all two-piece cages are secured together in matched pairs, by means of snap-on wire rings. Finishing is carried out in two stages, and a typical charge for the first stage comprises 80 lb. of components, 8 cwt. of bright honing chips, and 10 S. burring compound and water. With this charge the barrel is run at 10 r.p.m. for 3 hours, after which the water and compound are drained off. Fresh water, and No. 266 compound, are added for the second stage, which occupies 1 hour. Finally, the components are unloaded, washed, and dried in a warm-air oven.

Some further examples of methods employed by the company will be discussed in a later article.

PRODUCTION OF DOMESTIC REFRIGERATORS in the U.K. during October, 1957, was valued at £1,195,000. The average monthly value of domestic refrigerators produced in 1956 was £1,235,000.

Tungsten Carbide Lamination Die

An interesting example of the application of a solid tungsten carbide blanking die is afforded by the press tool shown in Fig. 1, which has been made in the toolroom of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester. This tool is designed to produce the 0·024 in. thick lamination, shown in Fig. 2, and it is now in use at the company's electricity meter factory at Motherwell, Scotland.

The die A, Fig. 1, was produced by spark erosion on a Sparcatron machine, and it is seen more clearly at *A* in Fig. 3, complete except for five fixing holes threaded $\frac{3}{16}$-in. Whitworth, and four clearance holes for the pilots. In producing this die, the punch *B* for the tool was first made from STYR high-speed steel (English Steel Corporation, Ltd.). It is of two-piece construction, ground all over, and fitted with a separate locating tenon, and is held in the punch plate by Cerromatrix, which flows into locking grooves, as at *X*, Fig. 3, ground in the surface.

This punch was used in conjunction with a Kirksite die for blanking-out laminations from 0·024 in. thick, half-hard brass strip, from which the electrodes required for spark erosion were built-up. The Kirksite die assembly, shown at *C* in Fig. 3, comprises a mild-steel die plate *Y*, which is dowelled and fastened by screws to a mild steel bolster, in which there is a sawn clearance aperture for the stampings. An aperture was

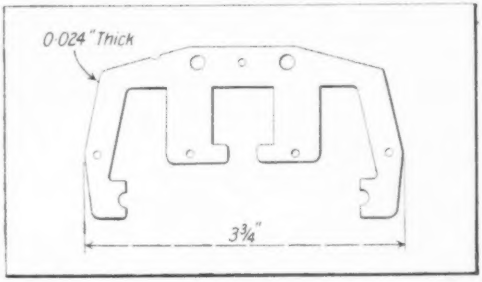


Fig. 2. Details of the Lamination Produced by the Tool Seen in Fig. 1

initially rough sawn in the die plate, approximately ⅛ in. larger all round than the blank size, and with the plate resting on a flat surface, and the punch *B* centrally-located, the Kirksite was poured in. The top and bottom faces of the plate were then cleaned up on a surface grinder, and the die aperture was backed off ½ deg. for clearance. Location for the guillotined pieces of brass sheet was provided by three stop pins on the die face, and the tool was fitted with a stripper plate, which was lined with Kirksite in a similar manner. For the blanking operation, the punch was held by Cerromatrix in a temporary holder.

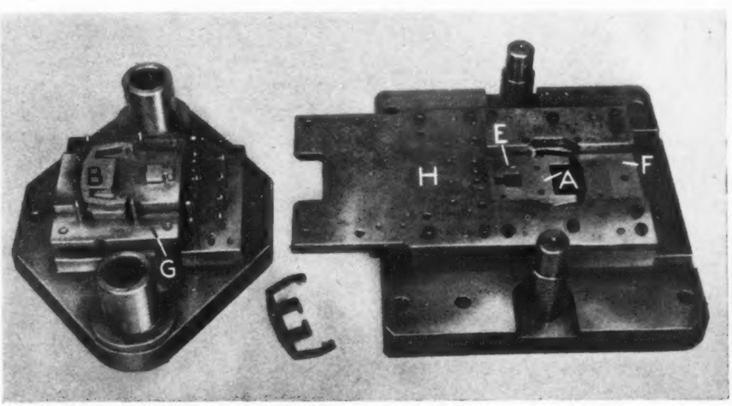


Fig. 1. Follow-on Press Tool With Solid Tungsten Carbide Die Section for Producing Electricity Meter Laminations

Three sets of 70 brass laminations were produced, to form three electrodes 1¾ in. thick, and the Kirksite die was re-ground after each set had been blanked. Using a simple drill jig fitted with slip bushes, and arranged to accommodate 10 blanks at a time, two $\frac{3}{16}$-in. diameter holes were then drilled and reamed, and an 0BA clearance hole was drilled in the centre, to accommodate two fitted bolts and a socket head screw whereby the blanks were clamped on

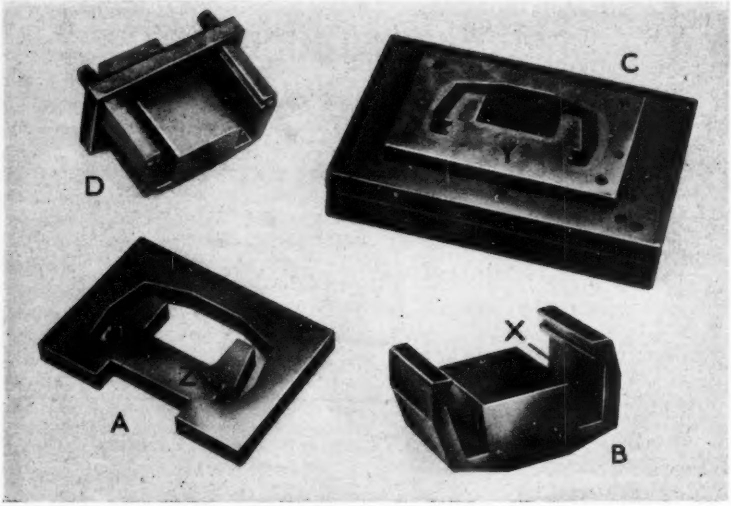


Fig. 3. The Partly-finished Tungsten Carbide Die Section is Shown at *A*, the Press Tool Punch at *B*, the Kirksite Die for Making Brass Laminations at *C*, and an Assembled Laminated Electrode at *D*

to the electrode holder, as seen at *D* in Fig. 3. A tenon block at the rear of the holder located the electrode in the spindle of the spark-erosion machine.

The sintered die block, which is ⅜ in. thick, was supplied by the company's subsidiary, Metro-Cutanit, Ltd., Warrington, with the rectangular side recess and the central rectangular aperture rough formed. This block was first ground on the top and bottom surfaces, and the edges, including the recess. To reduce the amount of material to be removed when spark eroding the die profile, a single row of holes was first produced round the form using an electrode of ¼ in. diameter on the Sparcatron machine.

Spark erosion of the actual profile was carried out first with a roughing electrode reduced on the periphery by 0·015 in., and then with a full-form electrode, as produced by the Kirksite die, except that the semi-circular recesses on the electrode, for forming the projections Z, Fig. 3, on the die, were enlarged to leave a finishing allowance. The dimensions and centre distance of these two recesses on the lamination are of importance for location purposes in the meter, and the die projections were finished, therefore, at a separate operation, using the third laminated electrode which was filed clear on the periphery except at the two portions in question. At the rough forming stage, the electrode was reversed on the holder half way through the operation, to bring the unworn portion into use, and the amount of taper produced in the work was thus reduced. The finishing operation was performed from the rear of the die block, so that electrode wear automatically resulted in the required back taper of about ½ deg. being produced in the aperture.

The five fixing holes, of ⁵⁄₁₆-in. Whitworth size, were produced with the aid of a threaded electrode and a lead screw attachment, and the four clearance holes for the pilots by means of conventional round electrodes. The Sparcatron machine used, it may be noted, has been in service for some time, and is of an early type. The company have, however, recently installed a Sparcatron Mark III 6·5-kW. machine, which has metal removal rates up to eight times as fast as the Mark II unit.

The die aperture, as spark machined, was somewhat smaller at the working face than the finished punch, because of electrode wear, and the necessary finishing operations were performed with the aid of a diamond laps and a Diprofil flexible-shaft reciprocating hand tool.

The die section *E*, Fig. 1, which is of die steel, was made by conventional methods, and, together with the tungsten carbide section *A*, is held in a recessed bolster plate *F*, which, in turn, is located in a recess in the bolster. Since the tungsten-carbide section does not require to be reground as often as the remaining parts of the die, a packing plate is provided beneath this section, which is reduced in thickness by an appropriate amount when the tool is ground, to maintain the level.

The remaining parts of the tool were made in a generally conventional manner. A spring-loaded stripper plate *G* is provided for the blanking punch and the centre-aperture piercing punch, and there is a fixed stripper plate *H*, fitted with hardened steel bushes, for the 10 round piercing punches. An essential requirement for the successful application of tungsten carbide dies is very accurate guidance of the top tool, and for this reason a Coley die set, incorporating ball bushes was used.

Equipment for Fusion Welding Large Pipes

New equipment has recently been installed at the Coatbridge works of Stewarts & Lloyds, Ltd., to facilitate the electric fusion welding of large pipes, and is said to offer important advantages as compared with the methods previously employed. This equipment comprises the Quasi-Arc/Torrance continuous edge former and seam welder shown in the figure, and an internal welding boom for making backing-up welds.

On the machine illustrated, pipes from 18 to 50 in. diameter, with thicknesses up to ⅝ in., can be handled. The pipe lengths are fed through the machine continuously, butted end to end, by a succession of rolls, which are power-driven from a 7½-h.p. motor, and provide steplessly variable welding speeds from 30 to 96 in. per min.

As each pipe length, which has previously been rolled into shape, enters the machine, the edges pass between two edge-forming rolls mounted one above the other. These rolls " break " the plate edges to produce a circular pipe with the faces correctly abutting at the joint. Five sets of edge-forming and drive rolls are required for the complete range of pipe sizes.

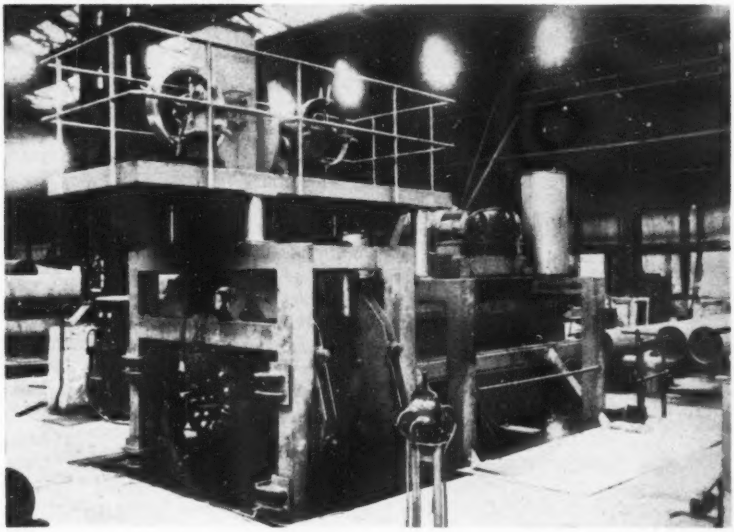
The machine is fitted with two Unionmelt D.S.H. welding heads arranged in tandem. The leading head is powered by a continuously-rated 1,200 amp. D.C. rectifier power unit, and the trailing head by a 1,000 amp. A.C. transformer power unit, continuously rated at 800 amp.

A copper backing shoe is positioned on the underside of the joint beneath the welding heads, being mounted at the end of a cantilever arm suspended at the entry end of the seam welder. A circulating water system provides for cooling the copper shoe, and, with the latter in position, complete weld penetration can be obtained. A continuous circulating system is provided for the granular welding flux. Because the pipes are fed continuously through the machine with the minimum of interruption, a high degree of utilization is achieved, and welding speeds range from 96 in. per min. for $\frac{3}{16}$-in. plate to 30 in. per min. for ⅝-in. plate.

The internal welding equipment comprises a Unionmelt D.S.H. welding head, with feed roll and nozzle assembly, mounted at the end of a 30-ft. long boom, which remains stationary while the pipe is moved on a traversing roller bed.

This boom is substantially rigid over the greater part of its length, but the end is supported by small rollers bearing on the bottom of the pipe. A closed circuit television system is used to enable the operator to see the line of joint ahead of the welding nozzle so that he can make any necessary adjustments. In this way, it is stated, accurate control can be maintained to ensure high quality welding in pipes down to 17½ in. diameter.

Welding flux is carried in a hopper, mounted at the end of the boom, whence it is fed by gravity to the weld zone.



This Quasi-Arc/Torrance Continuous, Edge Forming and Seam Welding Machine for Large Pipes is Installed in the Coatbridge Works of Stewarts & Lloyds Ltd.

Automatic Gauging and Marking Equipment for Taps

The range of products of the factory of Aktiebolaget C. E. Johansson at Eskilstuna, Sweden, includes taps. To provide for the rapid checking and grading of threaded tap blanks, the company has recently designed and constructed the special-purpose machine shown in Fig. 1. Incorporating two El-Mikrokator instruments, it is capable of checking and grading threaded components of sizes from 2 mm. to 20 mm., for effective and crest diameter, in 1½ to 3 sec. each, depending on the speed setting. The speed of operation can be varied within these limits, and the equipment is designed for use in conjunction with a hopper feed system (not shown).

Close-up front and side views of the gauging head are given in Fig. 2 and 3 respectively, from which the action of the automatic loading-arm *A*, and the arrangement of the gauging elements, may be observed. This loading-arm, which is seen in the retracted position, is arranged to oscillate about a horizontal axis, actuated by a cam, against spring tension. Forward travel is limited by the pin *B*, which engages the end of the adjustable stop-screw *C*. The fully-advanced position of the arm may thus be set accurately by means of the screw, independently of the cam profile.

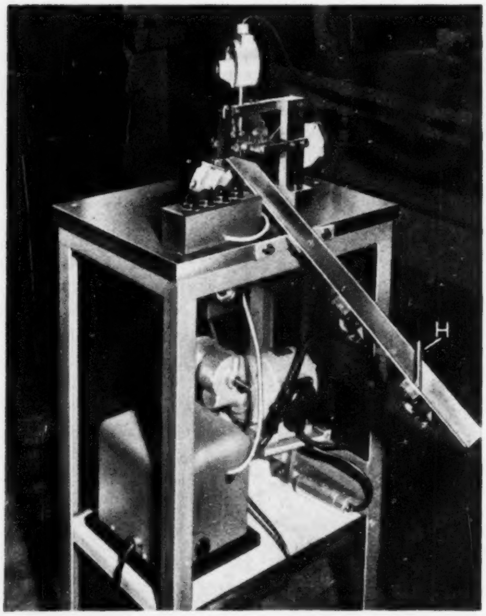


Fig. 1. This Special-purpose Machine, Designed and Built by C. E. Johansson, and Incorporating Two El-Mikrokators, will Automatically Check and Grade Taps at the Rate of 20 to 40 per min.

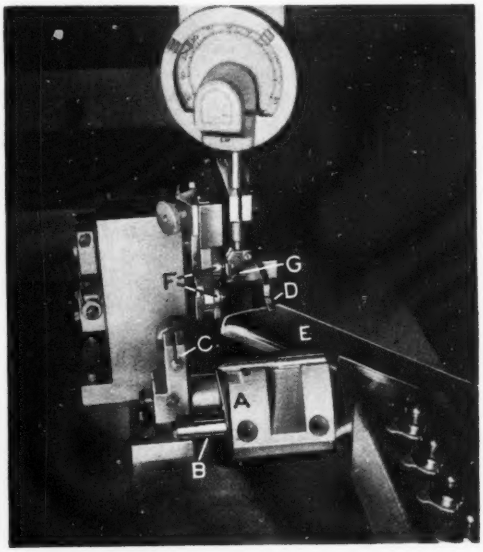


Fig. 2. Close-up Front View of the Machine in Fig. 1, Showing the Loading-arm *A*, and the Gauging Contacts

This method of driving the arm, also affords an automatic safeguard against damage to the machine, or personal injury, since the spring employed is comparatively light. In the event of a component mis-feeding, and being trapped between the end of the arm and some fixed portion of the head, only the spring pressure is exerted. Should an operator's fingers be trapped in the same way, this pressure is insufficient to cause injury.

When the machine is operated normally, in conjunction with a feed-hopper, a component is automatically delivered into a locating recess in the upper end of the arm, when the latter is at the limit of its outward travel. The hopper equipment, it may be noted, is so designed that the component is always delivered with the point towards the left. On the next inward stroke of the arm, the component is carried between the gauging contacts, after passing beneath the curved leaf-spring *D*. There is a brief dwell in the gauging position, and as the arm begins to move outwards, the leaf-spring *D* " hooks " the component out of the locating recess, so that it falls into the chute *E*. The arm then completes its outward movement, and another component is fed into the recess, in readiness for the next cycle.

In order to afford the necessary clearance for the gauging contacts, the arm is cut away, at the left-hand end in Fig. 2, so that only a narrow fin is left to back-up the work. The contacts *F*, for checking the effective diameter, are of the roller type, with ground thread-forms. There is a single thread on the upper, and two threads on the lower roller. These rollers are mounted on the limbs of a caliper-type head, which also carries the associated El-Mikrokator. The contact-stem of the latter is actuated by a bell-crank lever on one of the caliper arms, and the head is so designed that the gauging contacts are fully self-aligning. To this end, the assembly is mounted on a horizontal pivot, on which the various elements also have a limited degree of lateral " float."

To ensure that the work is not lifted off the supporting surface of the locating recess when it is engaged with the contacts, the assembly is also balanced about the pivot, and a hold-down spring *G* is provided, beneath which the work slides when the arm advances it into the gauging position. This spring holds the work down firmly on a small carbide anvil, which is set flush with the supporting surface of the locating recess. In the gauging position, this anvil is located vertically beneath a corresponding anvil, made of similar material, carried on the contact-stem of the second El-Mikrokator. The latter is mounted rigidly on an arm, and serves to check the crest diameter.

Referring again to Fig. 1, the cam which actuates the oscillating arm is driven from an f.h.p. electric motor, incorporating a reduction gear, through a V-belt. The motor is mounted on a table in the lower portion of the fabricated angle-iron frame, and the table also accommodates a double relay unit, to which the contacts of the El-Mikrokators are connected. This unit controls a set of coloured signal-lamps, which indicate " high," " low " and two " accept " grades, also two small trap-doors in the chute *E*, which segregate the accepted components automatically into the two grades. These grades, it may be noted, represent " first " and " second " taps. One of the trap-doors may be seen at *H* in Fig. 1, and it will be observed that it opens upwards, so the work is positively intercepted as it descends the chute.

All components oversize or undersize, whether on the effective or crest diameter, are discharged from the lower end of the chute. Components in the " accept " category, however, are directed into two bins placed beneath the chute. The trap-doors are actuated electro-magnetically, by impulses derived from the El-Mikrokator contacts and the associated relay-unit. To cover the overall diameter range, interchangeable carriers are provided for the oscillating arm, and a typical carrier will handle parts from 3 mm. to 6 mm. diameter. The equipment is capable of discrimination to 0·001 mm. (0·00004 in.).

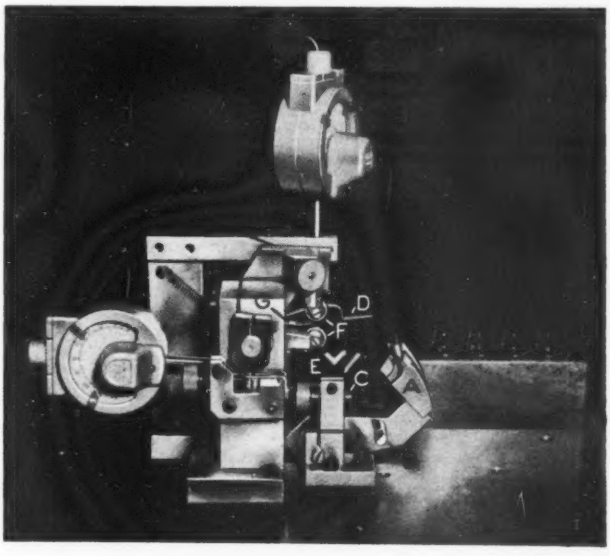


Fig. 3. Side View of the Machine Showing the Arrangement of the Gauging Heads

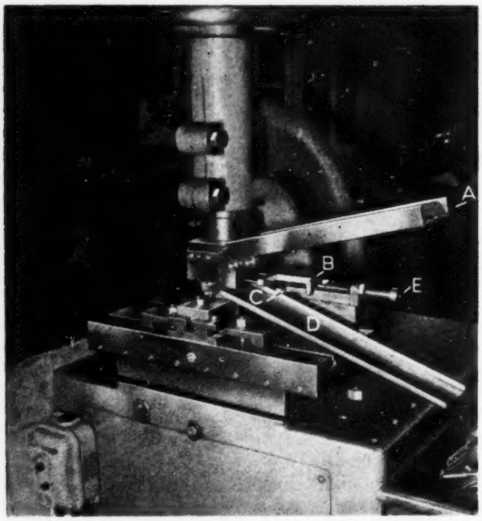


Fig. 4. This Special-purpose Machine, Developed by C. E. Johansson, will Roll-mark Tap Blanks at the Rate of 3,000 per hour

AUTOMATIC ROLL MARKING

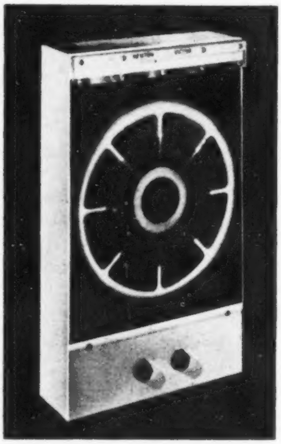
Another special-purpose machine developed and built by the company for use in connection with tap manufacture is shown in Fig. 4. This machine is employed for rolling the maker's name, and other information, on the shanks of tap blanks, prior to thread cutting and hardening. Designed for hand loading, it has an inclined channel-section magazine *A*, in which the blanks are placed, with the points all facing towards the left. At the lower end of the magazine there is a vertical portion, through which the pieces are fed, one at a time, into the gap between an upper, adjustable, stationary platen, and a flat marking-die. The latter is mounted on a reciprocating table, which is seen nearing the end of its working stroke.

Two pins are arranged to slide horizontally in the vertical portion of the magazine, and to their outer ends is attached the claw *B*. Shortly before the table completes its idle stroke, to the right, the claw *B* is engaged by the dog *C*, which is mounted on the table. The pins are thus withdrawn, and actuate a release mechanism, so that one component is delivered on to the marking-die. Then, when the table begins to move to the left, the component is drawn under the platen, and the marking operation is carried out.

Towards the end of the working stroke, the component rolls clear of the marking-die, and into the upper end of the inclined chute *D*, which delivers it into a bin. This chute, it may be noted, reciprocates with the table. At this stage, the end of the claw *B* is engaged by the adjustable screw *E*, which pushes the rods inwards, to re-set the release mechanism in readiness for the next cycle. A marked component is thus delivered at each double stroke of the table, which is normally run at 50 strokes per min. This figure does not, however, represent the maximum output capacity of the machine, as it could be run appreciably faster with hopper feed equipment.

Maxilume Radiograph Illuminator

An illuminator for viewing radiographs up to a maximum size of 14 by 17 in. is being produced by Newton Victor, Ltd., 132 Long Acre, London, W.C.2, a subsidiary of Metropolitan-Vickers Electrical Co., Ltd. The illuminator, which is shown in the accompanying figure, is of welded sheet steel construction and is arranged for wall or desk mounting. Two 15-watt colour-matched



Newton Victor Maxilume Illuminator for Viewing Radiographs up to a Maximum Size of 14 by 17 in.

fluorescent lamps are employed to provide an even, diffused light, without flicker.

The film holder is designed so that the extreme top edge of the film is not obscured, and a roller-blind masking set is available, which allows details of the radiograph to be inspected without distraction due to extraneous marginal light. A dimmer, to enable the illumination to be reduced steplessly to 15 per cent of the maximum, is available as an optional extra.

Fire Venting of Industrial Buildings

The occurrence, during recent years, of several disastrous industrial fires, has focused attention on the need for providing effective means for the escape of heat and smoke, in the case of fire, from stores and works buildings, in order that the spread of flame can be limited until firemen gain control of the outbreak. Fire venting, it has been demonstrated, is especially desirable in the early stages of an outbreak, otherwise the products of combustion, trapped in a confined space, become superheated to temperatures approaching 2,000 deg. F., and thus assist in the spread of flame by preheating adjacent inflammable material. Lack of effective fire venting is considered, by responsible authorities, to have been the main cause of the rapid spread of fires which seriously damaged a large refrigerator factory, and several important works engaged in motor vehicle manufacture. In one instance, it was the beneficial effect of accidental roof venting, caused by the explosion of an oxygen cylinder, that enabled firemen to gain control of the fire.

The amount of fire venting that is necessary in industrial buildings is almost impossible to calculate because of the many variable factors which affect the rate of burning of combustible materials. There is at present no officially recommended standard of fire venting applicable to industrial buildings in this country, and the current practice is to relate the effective opening area of the fire vents to the size of the floor below, on a percentage basis. In America, the combined hatch openings of the fire venting system are made equal to 2 per cent of the floor area for low fire loads, and 5 per cent for high fire loads. In the U.K., however, the figure is varied between 1½ and 3 per cent, on the assumption that the high level temperature above a normal fire is about 2,000 deg. F., which is sufficient to cause air to escape through a vent at 1,500 ft. per min. when the roof height is between 20 ft. and 40 ft. At this velocity, one air change per minute throughout the building will be provided when the vent area is 3 per cent of the floor area. The effect of fire venting is to cause a constricted upward draught of air to draw a fire into a confined area, rather than to allow it to spread sideways towards additional combustible material. When the smoke, fumes and heat are being removed to the open air, firemen can more easily locate and extinguish the outbreak without, as so often happens, causing additional damage by using excess water to prevent flash-over fires. The use of fire curtains suspended at intervals under the roof of an industrial building is also recommended as a supplementary means of preventing the spread of smoke and flames in a horizontal direction.

One firm which has carried out long and detailed investigations into the application of fire venting methods to industrial buildings is Colt Ventilation, Ltd., Surbiton, Surrey, one of a group of eight companies established in 1925. The main company initiated the development of a natural ventilation technique, and this work culminated in the development of a range of scientifically-designed ventilators for industrial and other uses. In consequence, the company was retained as a consultant to the L.M.S. Railway, the L.G.O.C., and other industrial undertakings. One of the most widely used ventilators in the Colt range has been the "clear opening" unit. When fully opened, this unit virtually removes the roof, allowing heat and fumes from machines and processes to pass freely out of the building. This ventilator has now been fitted with a fusible link control, designed to melt at 158 deg. F. In the event of fire, the link is broken and the louvres fall open automatically, so that heat, smoke and fumes are released, before

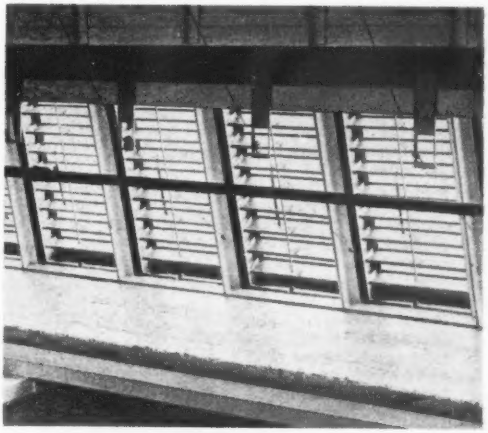


Fig. 1. Colt Clear-opening Dual Purpose Fire Ventilators which Form Part of a Large Fire Venting Installation at a Motor Vehicle Factory in England

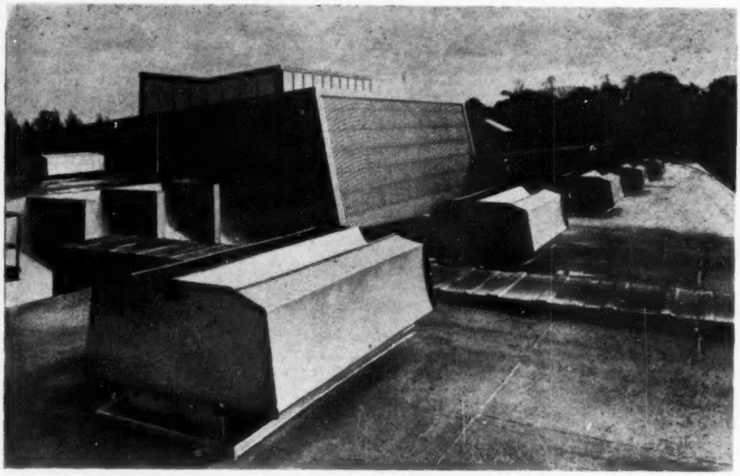


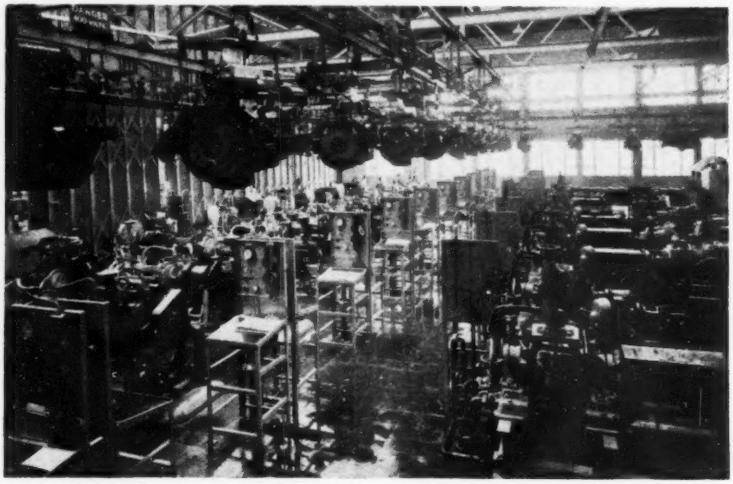
Fig. 2. Part of the Roof of an Aircraft Factory in this Country Fitted with Colt SRC Automatic Heat and Smoke Exhaust Ventilators

they can accumulate inside the building, and hamper the work of the fire-fighting forces. Such an installation is shown in Fig. 1, which depicts part of the ventilating system provided at a large motor vehicle factory in this country. If preferred, a screw-rod arrangement may be provided as an alternative to a cable system for controlling the opening of this type of ventilator. Although these ventilators have a large free area when fully opened, the design is such that the louvres prevent the ingress of rain when partially closed. The space between louvres is sufficient to permit access of hoses in the event of fire, yet narrow enough to present obstruction to flying brands.

Another Colt ventilator, now used extensively for industrial buildings, is the SRC type, and Fig. 2 shows a typical installation on the roof of a well-known aircraft factory in this country. This unit, also, combines the dual functions of normal ventilation and emergency heat and smoke venting in case of fire. A fusible link is usually fitted in the cable system which controls the damper movement, so that emergency opening of the ventilator occurs automatically.

A 16-mm. sound film has been produced recently by the Colt Film Unit, and runs for 13 min. This film shows diagrammatically, also by a sequence of a full-scale test fire, how automatic fire vents help to control a conflagration, yet provide efficient daily ventilation. This film, entitled " Fire Control in Industry," is available on free loan from the Film Librarian, Colt Ventilation, Surbiton, Surrey.

All the engine testing facilities of F. Perkins, Ltd., Peterborough, have now been centralized at the company's Eastfield factory, so that both new and reconditioned engines can be handled in one department. Engines of an increasing range of capacities and rated speeds can be tested efficiently. The illustration shows an extension to the test shop which was erected in 1956 and is equipped with 28 dynamometers, including 20 of the Heenan & Froude hydraulic type. Engines are delivered by a King " dual-duty " overhead conveyor

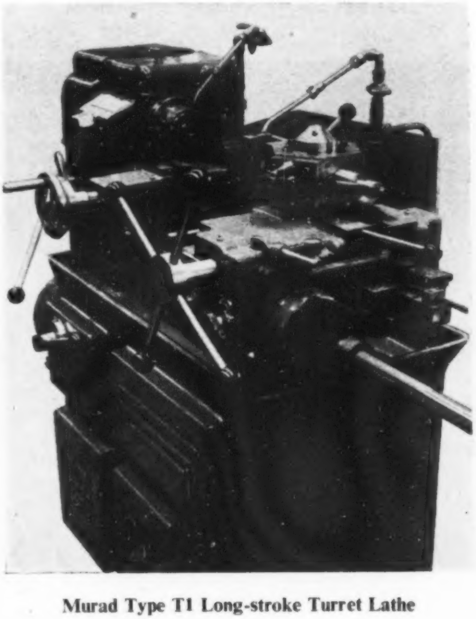


New Production Equipment

Murad Type T1 Long-stroke Turret Lathe

The type T1, 1-in. capacity, turret lathe shown in the figure, has recently been introduced by Murad Developments, Ltd., Stocklake, Aylesbury, Bucks., and is unusual in that the turret slide has a maximum working stroke of 14 in. on the bedways. It is stated that the diameter variation over the entire length of the component does not exceed 0·00025 in., when the full working stroke of the turret is employed.

Developed from the company's type 1B capstan lathe, the new machine will swing up to 11½ in. diameter over the bedways and 5 in. diameter over the cross slide, and the maximum distance between the spindle nose and the turret face is 20 in. Drive to the headstock is taken from a 2-speed motor of 1/4 h.p. through a 2-speed gear-box, thence by a V-belt and 4-step pulleys. The 16 reversible spindle speeds obtainable range from 62 to 1,800 r.p.m. An air-operated spindle brake is automatically applied when the reversing lever on the headstock is moved to the neutral position. The brake is also brought into use when the speed-changing lever for the gear-box is set in the central position and then moved towards the base. Selection of the motor speeds is made by pedals in the base. Automatic lubrication of the headstock gearing is provided. The spindle is bored $1\frac{7}{16}$ in. diameter and will take collets of dead-length design. A pneumatic bar feeding arrangement is provided, which is interlocked with the collet operation.

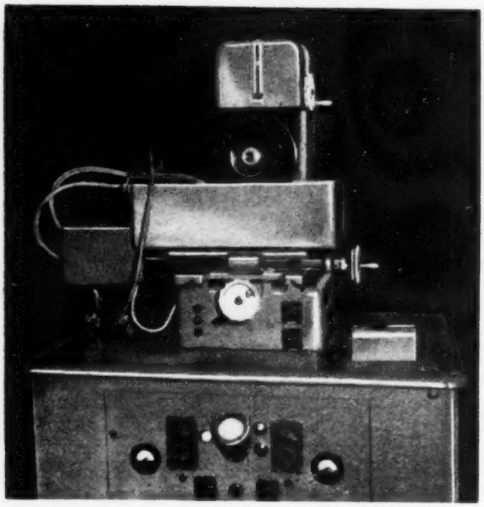


Murad Type T1 Long-stroke Turret Lathe

Six rates of power feed, from 0·002 to 0·019 in. per spindle rev., are provided for the turret slide, and the sliding motion can be interrupted, as required, by hand, or automatically by means of adjustable stops. The turret is indexed by hand, and can be rotated freely, after the locating plunger has been disengaged, by movement of a lever on the slide. The working stroke of the screw-operated cross-slide, up to a maximum of 4½ in., can be set by means of adjustable stops, and the rear toolpost is mounted on a slide which has a screw adjustment of ⅜ in., to facilitate setting. Coolant is delivered to the work by way of adjustable nozzles attached to the head-stock and the turret slide.

Usimu Type C2 Spark Erosion Machine

Shown in the accompanying illustration is the Usimu type C2 spark erosion machine introduced by La Qualitex-Dunod et Cie, Paris, who specialize in this field. It is seen equipped with a rotating electrode for producing components such as form tools, in tungsten carbide or steel. The machine can also be supplied with a head unit carrying a vertical electrode, for performing piercing and die profiling operations.



Usimu Type C2 Spark Erosion Machine

The rotating, disc-type electrode may be of brass, copper or carbon, the latter material offering the advantage that the profile can readily be produced by crushing with a simple steel template which need not be hardened. This template, suitably mounted on the work fixture, can also be employed for re-forming the electrode, if necessary, during the spark-machining operation.

Drive to the electrode is taken through a reduction gear from a small motor, and the speed is not critical since the principal purpose of rotation is to distribute the wear. With the electrode seen in the illustration, which shows a machine demonstrated at the 1957 Hanover exhibition, a tungsten carbide form tool, 1½ in. wide by ¾ in. thick, was produced in about four hours, at an electrode, speed of 100 r.p.m.

Vertical movement of the electrode head can be effected manually, also automatically, at variable feed rates, the maximum traverse being 4¾ in. An adjustable depth stop is fitted, and the maximum depth of hole that can normally be produced when using a vertical electrode is 1 9/16, or 3⅛ in. if the operation is carried out in stages, using two electrodes.

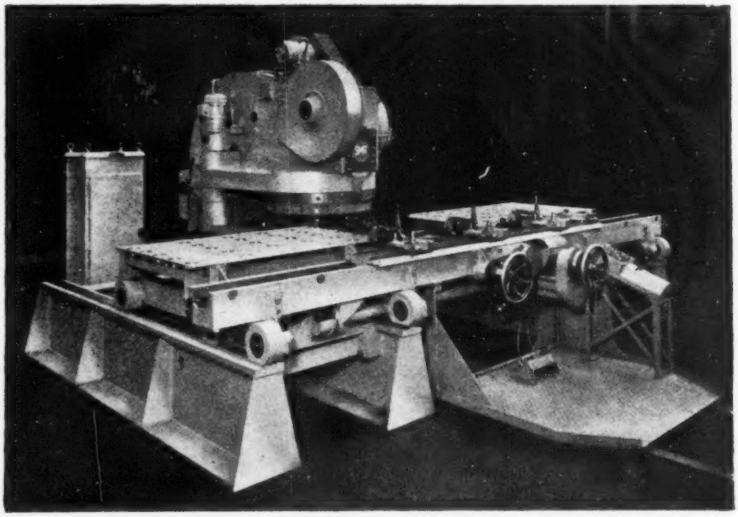
The table measures 16 by 8 in. and has a longitudinal movement of 8 in. Electronically-controlled, steplessly-variable power feeds are available, also hand traverse, and fine adjustments can be made with reference to a scale. Cross adjustment for the table saddle, through a distance of 4¼ in., is obtained by micrometer screw.

The fan-cooled electrical unit, which has a rating of 6·5 kW., is housed in the machine base and is readily accessible. Dielectric fluid is circulated by means of a gear pump.

The sole agents in this country for Usimu spark erosion machines are Elgar Machine Tool Co., Ltd., 172/178 Victoria Road, Acton, London, W.3.

Harvey 50-Ton Turret Punching Press

The 50-ton turret punching press, here illustrated, has been built at the Harvey works of the Scottish Machine Tool Corporation, Ltd., Govan, Glasgow, for punching or blanking a wide range of shapes in large steel plates up to 3/16 in. thick. It comprises two main units, namely the turret punching press and the spacing table, the work being placed on the latter and moved to the required positions beneath the punch. Sheets up



Harvey 50-ton Turret Punching Press

to 7 ft. long by 3 ft. 6 in. wide can be handled, and the throat depth of the press is 3 ft. 8½ in., so that a 3-ft. 6-in. wide sheet can be notched on the outer edge.

There are 24 tool stations on the 28-in. pitch circle diameter of the upper and lower turrets, which are mounted in ball bearings, and power indexed in either direction by a 1½-h.p. motor, controlled by a lever mounted on the control desk. The turrets are geared and locked together, positive location being provided by hardened and ground plungers.

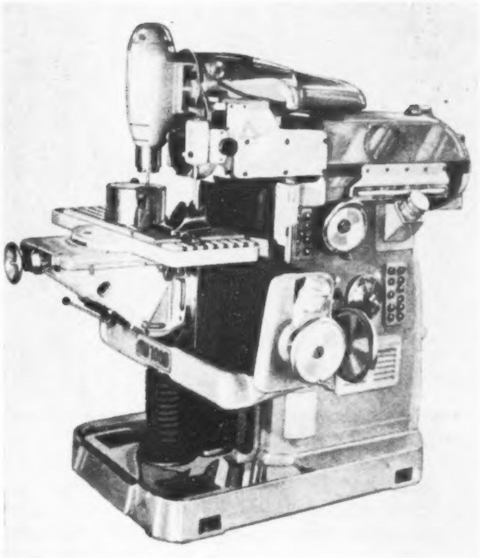
A 3-h.p. motor provides the main drive, through V-belts, friction clutch and gearing, to an eccentric shaft, which imparts a 1½-in. stroke to the punches. Of the air-operated type, the friction clutch and brake are controlled by a solenoid air valve, actuated by push-buttons on the control desk. An interlock prevents the clutch from being engaged until the turrets have been fully indexed and locked.

The sheet is positioned on the table by pushing it against a fixed stop at one end and against work clamps along the outside edge. After it has been clamped, the work remains in correct relationship to the measuring scales, which are of the direct-reading type. Movement of the sheet to the required position for piercing is effected by means of two handwheels, one of which controls the in-and-out motion of the table and the other the longitudinal traverse. Full-length steel scales, and graduated dials on the handwheels, facilitate positioning, and location is maintained by friction binder clamps which secure the table at each setting.

No marking-off is necessary, all operations on the work being performed from a punching chart. The first column of the chart shows the part number; the second column the punch number, corresponding to the size and shape of hole required; the third column the setting dimension in the longitudinal direction, and the fourth column the setting dimension in the transverse direction. The turret and tooling arrangements are such that holes can be punched in plates with flanges up to 1 in. deep.

Maho Type MH 1000 Universal Milling, Copying, and Jig Boring Machine

The accompanying illustration shows the Maho MH 1000 ram-type universal milling, copying, and jig-boring machine, introduced by the German firm Mayr, Hörmann K.G., for whom the sole agents in this country are Mortimer Engineering Co., 204/206, Acton Lane, London, N.W.10.



Maho Type MH 1000 Universal Milling, Copying, and Jig Boring Machine

A 39½- by 14¼-in. table can be swivelled up to 30 deg. in each direction, in the horizontal plane, on the knee top slide. The knee casting can be tilted forward up to 20 deg. on its mounting bracket, which, in turn, can be swivelled 20 deg. in each direction, about a horizontal axis, on the cross traversing saddle. This saddle has 23⅝ in. of longitudinal movement on guideways on the front, vertical face of the main slide member of the knee assembly, which has a vertical traverse of 19⅝ in. on the column ways. A transverse adjustment of 7⅞ in., by hand, is available for the knee top slide which carries the table. The spindle ram has a transverse movement of 19⅝ in. on the top of the column.

Steplessly-variable power feeds from 0·14 to $25\frac{3}{16}$ in. per min. are available for the ram, also for the table, vertically and longitudinally, and the Heid 2-dimensional or 3-dimensional electric copying system can be incorporated, to facilitate the production of moulds, dies, and cams, for example, Control of the feed gearboxes, also of the spindle gearbox, is effected through electrically-operated multiple-disc clutches, and speed and feed changes can be made while the machine is running. If desired, optical projection equipment and precision scales can be fitted for the movements of the ram transversely and the table longitudinally, which

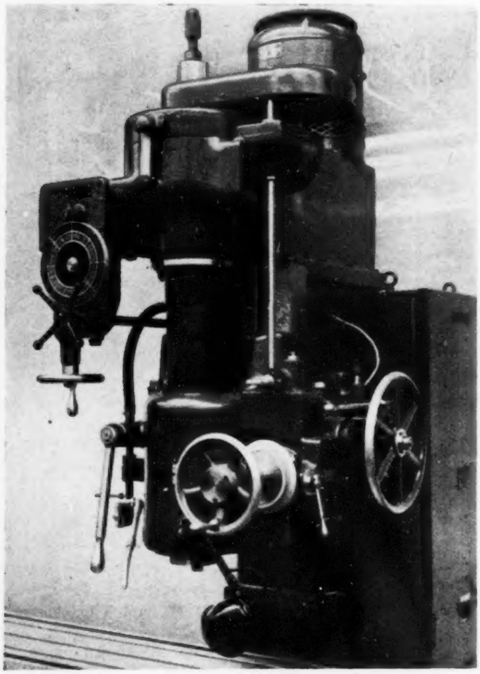
enable co-ordinate settings to be made to an accuracy of 0·0004 in.

In the illustration, the vertical spindle head is seen in the working position. The opposite end of the upper swivelling housing, which carries the head, forms an overarm support for a horizontal milling arbor, and on the left-hand side of the housing there is a slotting head. Drive to the spindles is taken from a motor of 4 h.p.

Power Down-feed Unit for the Herbert No. 47V Vertical Milling Machine

To increase its field of application, the No. 47V vertical milling machine made by Alfred Herbert, Ltd., Coventry, can now be fitted with an automatic down-feed unit for the spindle, as shown in the accompanying illustration. Three rates of down feed are available, namely 88, 165, and 330 cuts per inch, and the drive is taken by V-belt and reduction gearing from the spindle so that the correct ratio between speed and feed is maintained.

A 5-position turret, with adjustable depth stops,



Power Down-feed Unit for the Herbert No. 47V Vertical Milling Machine

provides for automatically tripping the feed, and there is also a large micrometer dial which, if set to zero at the beginning of the operation, will register the depth of hole that is being drilled or bored.

The No. 47V machine, which is noteworthy for its robust construction, has a milling capacity of 48 by 16 by 23 in., and the wide range of speeds and feeds available enables tungsten carbide cutters to be fully utilized for both light precision and heavy-duty operations, on a variety of materials. The new power down-feed unit is of particular advantage for toolroom work, for example, since it permits milling, drilling and boring operations to be performed at one setting of the workpiece.

Attachment for the Magna-Gage Electronic Comparator

Southern Instruments, Ltd., Industrial Division, Frimley Road, Camberley, Surrey, have introduced several attachments for use with their Magna-Gage electronic comparator.

The basic instrument, which was described in MACHINERY, 89/299—3/8/56, can be set by means of a rotary selector switch on the amplifier, so that full-scale readings of $\pm 0{\cdot}005$ and $\pm 0{\cdot}0005$ in., also 0·12 and 0·012 mm., can be obtained, separate sets of graduations for inch and metric readings being provided on the dial.

Readings down to 0·00001 in. are obtainable when the higher magnification is employed, and provision is made for zero adjustment of the pointer.

Housed in a cylindrical body, the measuring plunger is supported by diaphragms, so that friction-free movement, with a contact pressure of less than 2 oz., is obtained. Of compact design, the measuring head can be mounted in a variety of positions by means of simple, clamping arrangements, and, since special precautions have been taken to exclude dust and coolant from the moving parts, it may be set close to the cutting area of a machine tool.

The comparator is shown in Fig. 1 with the measuring head attached to a bench stand, and the amplifier mounted on a new signal-lamp indicator unit. This indicator unit is connected to the amplifier by cables at the rear, and three signal lamps, of different colours, are incorporated in an inclined panel at the front.

With a setting piece interposed between the measuring head and the anvil of the bench stand, the amplifier is set, by means of the zero adjustment knob, to give a reading which corresponds with the specified upper limit of workpiece size.

A knob on the indicator unit is then rotated until the green signal lamp is extinguished and the red lamp is illuminated. This procedure is repeated to obtain a setting for the lower limit of workpiece size, which is indicated by a blue signal lamp, and finally the pointer of the amplifier is adjusted for zero. The signal lamps then indicate whether workpieces are within the required limits, and reference need not normally be made to the pointer and scale on the amplifier.

By setting a switch on the indicator unit, illumination of the signal lamp for maximum or minimum reading can be maintained after the workpiece has been removed from the measuring head. This feature is of particular advantage when cylindrical parts are being checked, since the signal lamp indicating the maximum reading may otherwise be illuminated only momentarily. Subsequently, the lamp is extinguished by pressing a push-button.

The relays which operate the signal lamps are fitted with additional contacts connected to a socket at the rear of the indicator unit, and may be employed for controlling the operating cycle of an associated machine. For example, one relay may provide for the automatic engagement of a reduced feed rate on a grinder at a predetermined point in the cycle, and the second relay for stopping the machine when the workpiece has been brought to the required size.

Weighing 9½ lb., the indicator unit occupies a space of 9 by 9 in., and is 4 in. high. It can be supplied for operation on single-phase supplies of 100/115 and 200/250 volts, and has a power consumption of 20 watts.

Fig. 1. Magna-Gage Electronic Comparator and Signal Lamp Indicator Unit

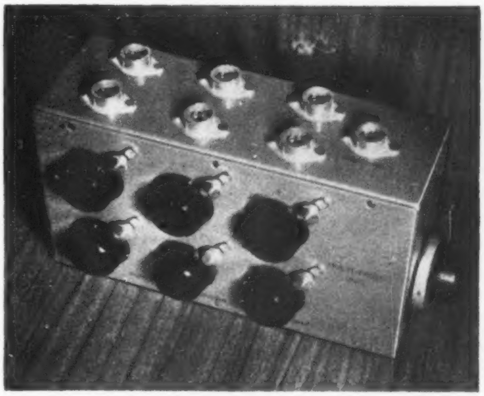


Fig. 2. This Unit Enables a Maximum of Six Measuring Heads to be Used with the Amplifier of the Magna-Gage Comparator

The unit shown in Fig. 2 enables a maximum of six measuring heads to be employed in conjunction with a single amplifier, for example, for checking various dimensions on a workpiece. It has separate sockets for connection to the amplifier and to the measuring heads, and the latter are selected in sequence by means of a rotary selector switch. Zero adjustment of the pointer on the amplifier for each measuring head is obtained electrically by means of a separate knob, and the need for providing fine setting arrangements on the heads themselves has thus been avoided.

Steel or tungsten-carbide tipped end pieces can be provided for the plunger of the measuring head. Probe-lifting attachments are also available, which enable the measuring plunger to be raised through a distance of 0·06 in. in order to facilitate the insertion of thin and fragile parts between the probe tip and the anvil.

In addition, there is a side-acting attachment also available which can be fitted to the standard probe unit. Sideways movement of the pin is transmitted to the plunger of the measuring head by a friction-free spring system. When the measuring head and attachment are mounted horizontally, the comparator can be used as a sensitive height gauge. All these attachments can be readily mounted on the measuring head after removing a threaded end cover.

Buck & Hickman, Ltd., 2 Whitechapel Road, London, E.1, are the distributors for Magna-Gage electronic comparators.

Mägerle Fully-Automatic Crush Form Profile Grinder

Shown in the accompanying illustration is a fully-automatic hydraulic profile grinder, equipped for crush forming, which has been introduced by the Swiss firm Mägerle, for whom the sole agents in this country are Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11.

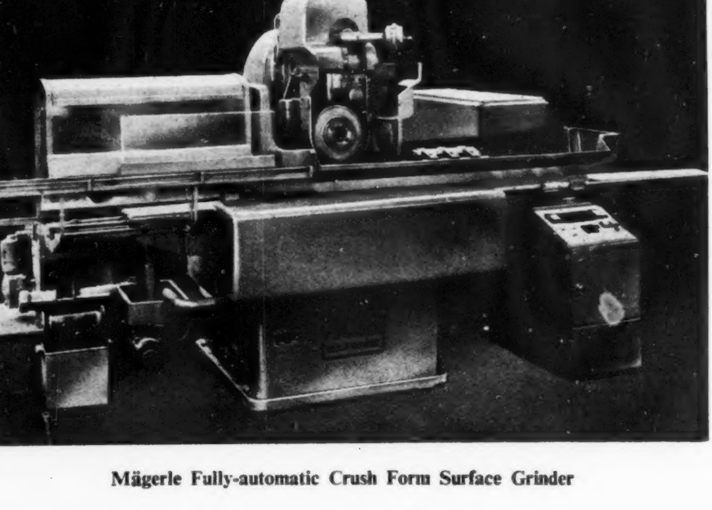
This machine is available in three sizes, known as the types FP7A, FP10A, and FP12A, with table working surfaces of 29½ by 9 7/16, 41¾ by 9 7/16, and 49¼ by 9 7/16 in. Grinding wheels up to 4 in. wide can be fitted, and on each machine the clearance under the wheel is 15¾ in. Steplessly-variable traverse speeds up to 100 ft. per min. are provided for the table, which moves on ways of patented design, and automatic down-feed to the wheel-head can be applied in increments which can be varied from 0·0001 to 0·0005 in. per table stroke.

The crush forming device is built into the wheel-head and in no way interferes with the operation of the machine for normal surface grinding. A hydraulic dressing device, interlocked with the crush forming unit, is provided for truing the periphery of the grinding wheel. Means are incorporated for compensating automatically for the reduction in diameter of the grinding wheel, also for checking the transverse position of the wheel after crushing, which is of importance, for example, when indexing grinding operations are being carried out. Provision is also made for maintaining a constant peripheral speed for the wheel, to ensure efficient cutting. The machine has been designed particularly so that it can be operated without the need for special skill, and it is stated that the change-over from one job to another requires only about 15 min. Accurate positioning of the table transversely, as may be desired in certain cases, can be effected by the use of gauge blocks.

When the start-cycle button is pressed, the coolant starts to flow and the table advances to the working position and then traverses at the reduced speed of 15 ft. per min. so that any unevenness in the workpiece surface is removed without the risk of overloading the grinding spindle motor. After the first pass, the speed of the table reciprocation is increased to 100 ft. per min., and increments of roughing down-feed are automatically applied until a pre-set depth is reached, whereupon the table runs out and stops, and the grinding spindle motor is switched off and braked.

The crushing roller is then fed-in hydraulically, with the wheel rotating slowly, and upon completion of the forming cycle, during which the roll is fed to a pre-set depth and a selected minimum pressure is applied, the crushing-roll motor is stopped and the wheel spindle is again accelerated to grinding speed. Table reciprocation is then resumed and fine increments of down-feed are applied until the required size is reached. A time relay comes into operation to control sparking out, and, at the end of this stage, the wheel-head retracts, the coolant flow is stopped, and the table runs out to the loading and unloading position.

When handling large batch quantities, maximum output is ensured by the use of magazine feeds for the workpieces, and one operator can then



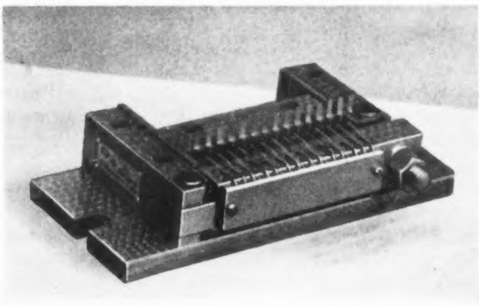
Mägerle Fully-automatic Crush Form Surface Grinder

tend several machines. All the automatic functions of the machine can be operated independently, under manual control, after a selector switch has been moved from the "automatic cycle" to the "setting up" position. Provision is made for rapidly regrinding the crushing roller while it is in position on the machine, after the wheel has been crush formed with a master roll.

ZB Autogrip Milling Fixture for Cylindrical Parts

Shown in the illustration is the ZB Autogrip milling fixture for holding cylindrical parts, which has recently been placed on the market by Z. Brierley, Ltd., Llandudno.

Workpieces are gripped, vertically, between a



ZB Autogrip Milling Fixture for Cylindrical Parts

block attached to the 13½- by 6-in. base, and a number of rollers which are held in contact with the pivoted clamping arm by wire clips. The clips, which are retained by a slotted plate attached to the outer edge of the clamping arm, permit small movements of the contact rollers so that they can accommodate themselves between the workpieces. With this arrangement, when the arm is swung to the closed position and tightened, similar clamping pressures are applied to all the workpieces irrespective of any small diameter variations.

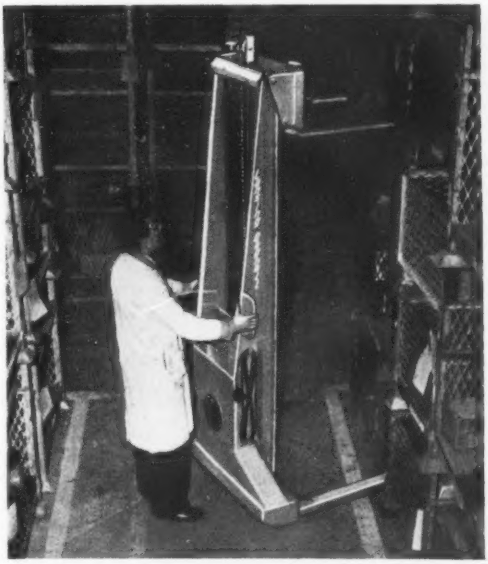
V-shaped serrations are provided on the mating surfaces of the base and the 2-in. thick block, so that the latter can be set in different positions to suit workpieces from ¼ to 2 in. diameter. When the block has been set, it is secured by screws and nuts which engage with slots in the base. Contact rollers of ¼, ⅜, ½, ⅝ and ¾ in. diameter are available in sets, and the fixture will accommodate, for example 15 workpieces of ¼-in. diameter, or 4 workpieces of 1½-in. diameter.

Hardened steel wear plates are attached to the inner edges of the clamping arm and block, and to end pieces which are secured to the base by screws. The clamping arm can readily be swung clear to facilitate cleaning the fixture. Pins are provided in the base, which can be brought into engagement with T-slots in the table of the milling machine for location purposes. The fixture weighs 41 lb.

Lansing Bagnall Type FSHP 1 Hand-Propelled Stacker-truck

As may be seen in the illustration, the FSHP 1 hand-propelled stacker-truck, which has been developed by Lansing Bagnall, Ltd., Kingsclere Road, Basingstoke, Hampshire, can be used in restricted spaces, the gangway shown being only 6-ft. wide.

The forks will raise 10 cwt. at 15-in. load centres, and hydraulic power for lifting is provided by an electric motor driven, piston-type, high-pressure pump. Power is supplied by a 12-volt battery. Lifting speed is approximately 10 ft. per min., and the movement is controlled by push-buttons. Trucks with straddle-widths up to 42 in., and lift heights up to 84 in., are available, and the lifting forks can be adjusted across the full face of the fork carriage.



Lansing Bagnall Type FSHP 1 Hand-propelled Stacker-truck

L

Economies Obtained by Using Extruded and Die Cast Aluminium Parts

By HERBERT CHASE

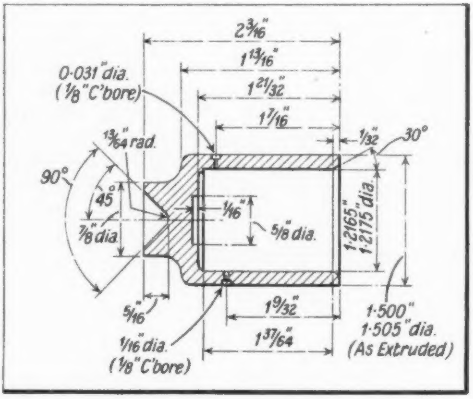


Fig. 1. The External Surface of this Aluminium Piston Sleeve is Finished at the Extrusion Operation. The Bore is Machined to Close Limits After the Open End has been Bored

At the Indianapolis factory of the Chrysler Corporation, U.S.A., important large savings have been obtained by changing over to aluminium for two servo components of the PowerFlite automatic transmission. Formerly turned from steel bar stock, these parts are now produced from impact extrusions and die castings made by outside suppliers. Although the sizes are substantially the same as for the steel parts, only a minimum of machining is required in the company's shops.

The required output can thus be maintained with fewer machines, which take only light cuts at high speeds. Moreover, the volume and weight of chips have been greatly reduced. These components perform quite as well as the steel parts which they have replaced, so that there has been no sacrifice of quality.

It is the smaller of the two parts, known as a transmission reverse servo piston sleeve, which is made by impact extrusion.

A sectional view of this component is shown in Fig. 1, and, as close dimensions are held, practically the whole of the outside surface remains as extruded. After the open end has been trimmed on a LeBlond lathe, most of the machining is completed on two pieces at a time, on the Ex-Cell-O boring machine shown in Fig. 2. Here the bore is finished to 1·2165/1·2175 in. diameter, to a depth of 1 37/64 in., with a surface roughness not exceeding 30 micro-inches. An inside chamfer is also formed and the burr is removed from the outside edge.

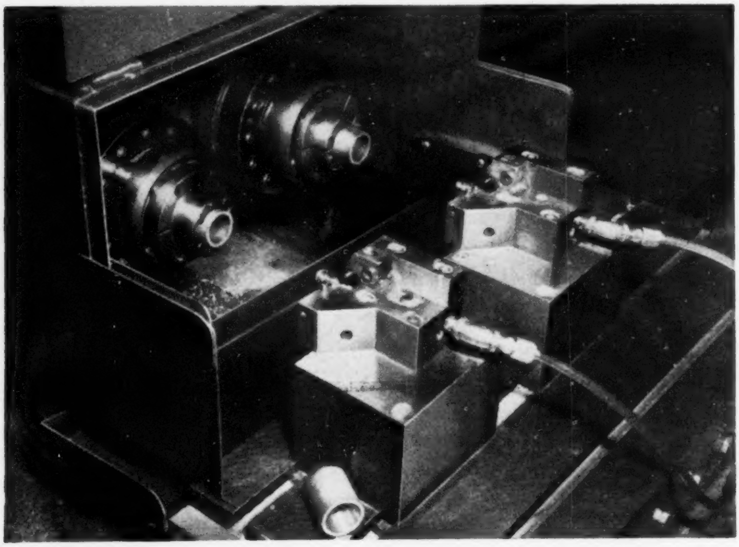


Fig. 2. Set-up for Precision Boring Two Extruded Sleeves

Formerly, a blank

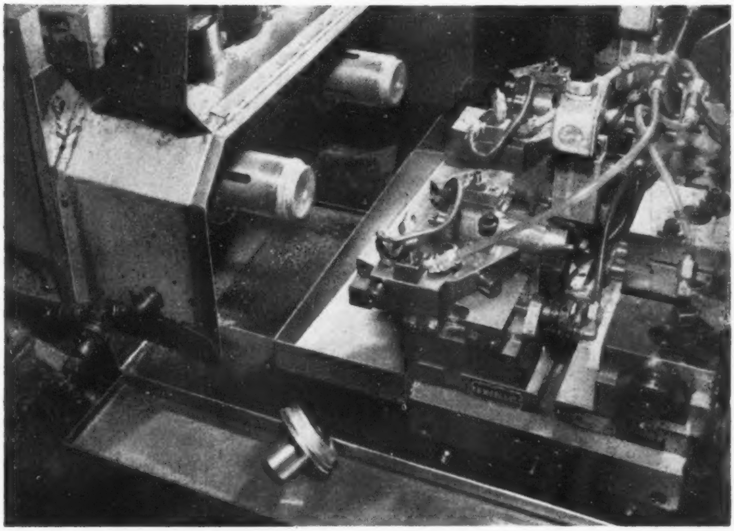


Fig. 3. Set-up for Boring the Small Hole, Facing the End, and Forming the Groove in Two Die Cast Pistons

was produced on a 6-spindle automatic on which the outside surfaces were turned and formed. The parts were then passed to a chucking machine for drilling, rough-boring, and machining the steps at the bottom of the hole, after which a boring machine was employed for finishing the bore. In both the steel and aluminium components, small cross-holes are required which are drilled on a Kingsbury machine. It is not necessary to finish the closed end of the extrusion, which costs considerably less than the original part machined from steel.

The PowerFlite automatic transmission reverse servo piston is shown in section in Fig. 5, and production at the necessary rate, from steel bar stock, required nine machines (three bar automatics, three chucking automatics, and three precision boring machines) each with an operator. Now that the components are die cast from aluminium alloy, all the operations required are performed on three Ex-Cell-O boring machines, one with two spindles and the other two with four spindles each (two at each end). Three operators are required, one for each of the boring machines.

On the 2-spindle machine, the two castings are held in air chucks by the largest diameter, for boring. Next, these two castings are passed to the left-hand end of one of the two 4-spindle machines, where they are held in air chucks by the cylindrical extension *A*, as shown in Fig. 3, At this set-up, the small hole *B* at the flanged end is bored, and the surfaces *C* and *D* are turned. In

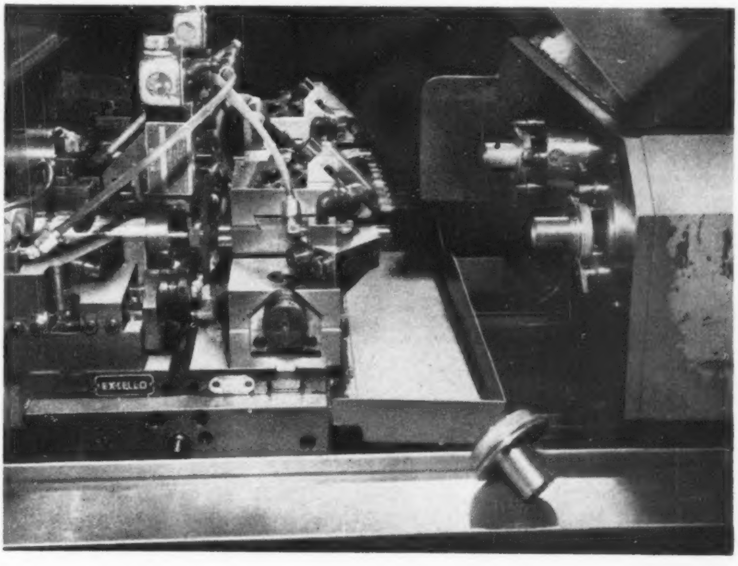


Fig. 4. At the Final Machining Stage, Fine Turning, Facing and Grooving Operations are Carried Out

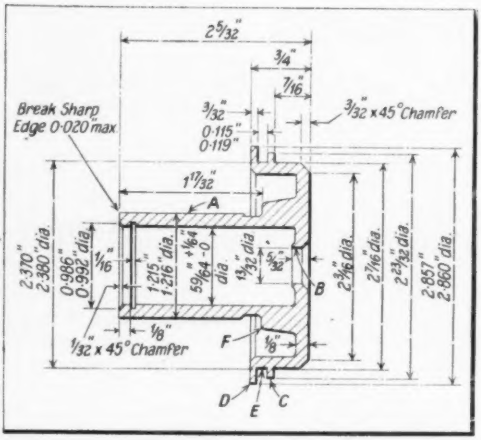


Fig. 5. This Transmission Reverse Servo Piston is now Made as an Aluminium Die Casting. Boring, Turning, Facing, and Grooving Cuts are Completed in Three Stages

addition, the outer ring groove *E* is formed and the end is faced to provide a location surface.

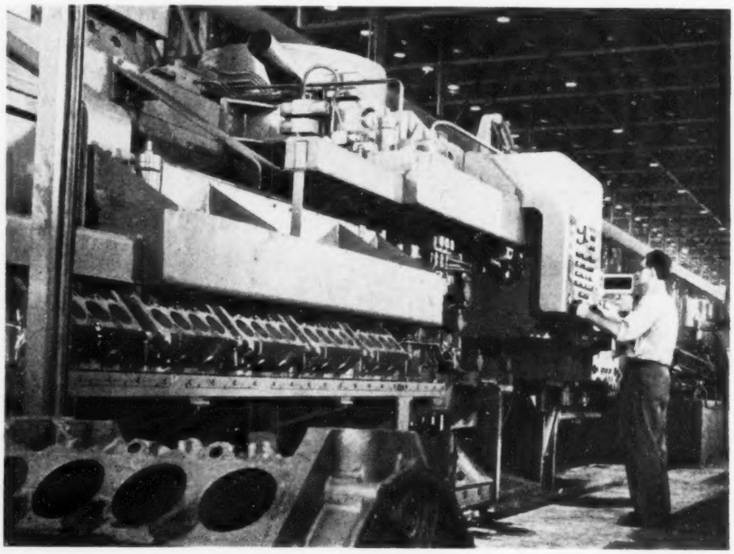
When these operations have been completed, the parts are transferred to the opposite end of the same machine, as seen in Fig. 4. Here, they are located by the small hole and finished face of the flange, and the cylindrical extension *A* is turned to limits of $\pm 0{\cdot}0005$ in. with a surface roughness not exceeding 20 micro-inches. The step *F* is then faced, also the bottom of the recess and the end of the extension. In addition, a ring groove *G* is cut. There are 26 tools on each double-ended machine, and 700 pieces are finished on each of these machines during an 8-hour shift.

By using a die casting, which is supplied close to finished size, and machining it as described, a large saving per piece is achieved.

Large Broaching Machine for Cylinder Blocks

The Plymouth Division of the Chrysler Corporation, U.S.A., has recently installed in the Qualimatic V-8 factory the large Cincinnati broaching machine here illustrated. There are two work stations, and, at each stroke of the machine, the sump face, bearing diameter and bearing cap faces of one block, and the bank faces, inlet manifold face, and various lugs of a second block, are broached. After leaving the first station, the block is transferred to a turn-over fixture, whereby chips are discharged, before it is loaded at station 2.

To facilitate broaching, fairly close limits are maintained on the castings. An extra 4 ft. of ram stroke is, however, available, beyond that normally required, and it is stated that an additional $\frac{1}{16}$ in. of stock can be removed if necessary. The ram is mechanically operated and it is claimed that the steady movement thus obtained helps to reduce tool breakage. A second 2-station machine is employed for broaching the ends of the blocks.



Large Cincinnati, 2-station, Mechanical Type Broaching Machine for Cylinder Blocks

The Machine Tool Trades Association Annual Dinner

At the annual dinner of The Machine Tool Trades Association, which was held at Grosvenor House, London, W.1, on March 26, the president, Mr. J. C. Robinson, proposed the toast of "The Guests."

They had asked Sir David Eccles, President of the Board of Trade, to join them and had been delighted when he accepted their invitation. Less than a week ago, he had told them that another engagement, which was quite incapable, would prevent him from keeping his promise. Happily, they had been able to fill his place, and their most grateful thanks were due to Mr. Erroll, the Parliamentary Secretary of the Board of Trade, for stepping into the breach at very short notice. Mr. Erroll was well known to the industry. An engineer himself, he had travelled widely on Government business and knew intimately and at first hand many of the important markets for machine tools. He was, Mr. Robinson believed, the first British Minister ever to visit China, a country which they hoped to supply with many of the machine tools she would inevitably require for her industrial expansion.

For their second speaker, they had Mr. C. F. Cobbold, the Governor of the Bank of England. Mr. Cobbold's name was a household word, and we owed it to him and his colleagues that the reputation of the Bank of England never stood higher than it did today. His presence, welcome in itself, had a certain symbolic aspect, for present trends in the machine tool industry were making them more and more aware of overriding financial considerations, "whether relating to the difficulties inherent in a sustained policy of credit restriction at home, or the increased export trade that could flow from a less restricted exchange of currency and a more generous credit policy."

He was particularly pleased to welcome Sir Gilbert Rennie, High Commissioner for the Federation of Rhodesia and Nyasaland, a new country and a market which, he felt sure, must shortly make increasing calls upon the resources of their industry. There were representatives present from countries which were, at the moment, hardly more than potential markets, and of countries which were vigorous commercial rivals, but with whom we maintained a constant interchange of trade in both directions as well as of ideas and information. Every Continent in the world was represented, and great amity always prevailed on international occasions whenever engineers got together. Some, perhaps, might be tempted to wonder whether engineers would make a better job of running the world than the politicians. However, that might be, of one thing they were quite sure, namely that they were certainly better qualified than the politicians to run their own industry.

Concluding, Mr. Robinson emphasized that the machine tool industry eschewed narrow nationalism and welcomed, whether in markets overseas or in this country, that keen competition which alone secured the constant development of a dynamic industry.

Mr. J. C. Robinson, President, M.T.T.A. (right), Mr. C. F. Cobbold, Governor, Bank of England, Mr. F. J. Erroll, M.P., Parliamentary Secretary, Board of Trade, and Mr. E. W. Field, O.B.E., Vice-President, M.T.T.A.

Mr. F. J. Eroll, M.P. (Parlimentary Secretary, Board of Trade), who responded, expressed the apologies of Sir David Eccles, the President of the Board of Trade, for his unavoidable absence. He had been particularly looking forward to the occasion.

The engineering industries, it need hardly be said, occupied a place of ever-increasing importance in our economy and in our exports, and modern engineering manufacture would be impossible without the contribution made by the machine tool industry. Apart from the actual supply of machines, moreover, the industry played an important role in advising on the best types of machine for particular production jobs, so that machine tool makers were, in a way, production consultants.

It was hard to think of any industry which did not directly or indirectly benefit from the services of the machine tool builders. Indeed, the majority of the modern comforts of living depended, in part at least, upon the work that they did.

In the past seven years, the value of the production of the machine tool industry had increased by no less than 140 per cent. At the same time, the industry has made many technical advances. Much had been done to adapt electronics to machine tools, automatic control devices were now highly developed, and the production of transfer equipment had been expanded. In matters of research and development, there was always a great deal to be done, and everyone in the industry was to be congratulated for giving full attention and support to research and design.

In 1957, records were established both for machine tool production and for exports. At £28 million, exports had exceeded by more than £4 million the figure for the preceding year, and exports to the U.S.A., at £2,700,000, were the highest yet achieved—a result which was due to continued effort in a difficult market, over a period of years.

In some of the principal markets, machine tool builders were faced with balance of payments difficulties and a general slackness of business, and in the circumstances, increased export effort was all the more essential.

The Board of Trade was always anxious to help those who wished to increase their exports. There was an Export Services Branch in London, and the overseas representatives—the Trade Commissioners in the Commonwealth and the commercial departments of the diplomatic missions and consulates in foreign countries—were all anxious to help in this vital task of increasing exports.

The machine tool industry, while it did not minimize the difficulties, realised the wide prospects offered by the proposed European Free Trade Area to manufacturers who combined good products with dynamic salesmanship.

The committee which had been set up to negotiate these matters, under the chairmanship of

Sir William Rootes, G.B.E., Chairman, Dollar Exports Council (left), Mr. R. H. Owen, C.M.G., Comptroller-General, Export Credit Guarantee Department, and Mr. R. Reid-Adam, C.B.E., Assistant Secretary, E.6, Board of Trade

Sir Greville S. Maginness, K.B.E., Past-President, M.T.T.A. (left), Mr. J. Dzierzynski, Commercial Attaché, Polish Embassy, and Mr. V. A. Kamensky, Leader, U.S.S.R. Trade Delegation in the U.K.

Mr. Reginald Maudling, had made a good deal of progress, and on the whole the atmosphere of the discussions had been good. On some subjects, provisional agreements had already been reached, and in other cases there was sufficient common ground to enable work to be continued with good hope of agreement.

There were, however, a number of tasks still to be completed, and one of the most difficult problems had been to analyse and clarify the feeling of the French Government, in particular, because the French felt that the Free Trade Area presented dangers which were not present, or which had been mitigated to some extent, within the Treaty of Rome. The French opinion was that they should have time to acclimatize themselves to the removal of protection among the six countries, and they were not by any means sure that they were ready to embark on a wider field of competition. They were therefore considering a Free Trade Area agreement of restricted scope, and, perhaps, of delaying its introduction, or failing that, at least the provision of safeguards against the dangers which they foresaw. It was, however, far too early to say what would be the outcome of the negotiations which were now being conducted in Paris. What was at stake in the negotiations was not only trading relationships in Western Europe, but the very much wider political implications for the future co-operation among Western European countries in every sphere of economic and political activity.

At the end of last May, the British Government had reduced the size of the embargo list of goods which could not be exported to China, and had thus made available to China a much wider range of goods, particularly machine tools, generating equipment, agricultural tractors, and motor vehicles, which it had not previously been possible for the Chinese to purchase. He (Mr. Erroll) had visited China last October to explain to the Chinese Government the new opportunities which now existed, and to see for himself something of the developments which were taking place in China today.

Three years ago, he had visited a number of machine tool factories in Russia, and last October he saw many Russian machine tools installed in a a number of fine new Chinese factories. He was also able to see the machine tools which the Chinese were now making for themselves and which they were already beginning to export, although on a small scale.

The embargo list was again being reviewed by the Co-ordinating Committee in Paris. In that review, our policy was to restrict the embargo list to goods which were still of strategic significance. We were determined to proceed in agreement with our allies but to conduct that review with vigour, enterprise and foresight.

Sir William Stanier, President, Production Engineering Association of Great Britain, (left) and Sir Hugh Beaver, K.B.E., President, Federation of British Industries

We could indeed extend a cordial welcome to the Chinese purchasing mission which was about to leave China for the United Kingdom. We welcomed the Chinese technical mission to England last October and November, and it was good to see that the impression which we then created on them had led to the dispatch of this purchasing mission.

In conclusion, Mr. Erroll congratulated the Association on the informative booklets and other material which they were now distributing.

On behalf of all the guests, he expressed thanks for the hospitality they had received and wished the industry all success in the future.

Mr. C. F. Cobbold (Governor of the Bank of England), in proposing the toast of "The Machine Tool Trades Association," said that their business touched his on two very essential points. Their efficiency was essential to the efficiency and to the competitiveness of British industry as a whole, and their work made a most notable contribution to our export markets, both in its own right and in the services rendered to the main exporting industries.

It was often suggested that the reasons for maintaining and extending the international use of sterling were connected purely with the various financial services—banking, insurance, and so on—which we provided, largely in the City of London.

It was very true that these financial services made a most valuable direct contribution to our invisible exports. As he saw it, however, the contribution of sterling, and of the financial services, was something far wider than these invisible exports in themselves. Successive Governments had taken the view that the country's interests were best served by an increasing level of world trade and an increasingly multilateral basis of world trade. If that view was right—and it was a view which he held most strongly—then it was nonsense to maintain that the international strength and utility of sterling, and the banking and financial services which London had to offer, were things which concerned merely the City of London.

Certainly our overseas liabilities imposed, on occasion, a heavy strain upon us. The changed relation of our assets to our liabilities was, however, largely the result of war, and the burden on us would, he believed, be no easier—indeed, it would probably be harder—if we attempted to retreat into a world of compartments and bilateralized currency arrangements. For British trade, and for world-wide trade, in which we had an interest, both from our own selfish point of view and as a contribution to international progress, any such retreat to bilateral trade would be a major disaster. If, therefore, as seemed possible, we were running into a period when it would be more difficult to keep up the level of world trade, it was all the more important that we should develop and not reduce the attractions and the usefulness of sterling as a trading currency.

Last month, at Guildhall, he had said that the battle against inflation was only half won and that the general lines of last September's policy must be continued until that half was converted into a whole. He would still say that inflationary pressures, although damped down rather more than was evident six weeks ago, were still "lurking around."

With patches of recession round the world, the length and depth of which we could not yet judge, but which looked a little more threatening than they did in February, the worst service we could do to our prospects of high employment and good living standards would be to allow inflation to continue in the United Kingdom and thus price ourselves out of world markets. Until we had killed inflation, we were clearly bound to hold back many things which in themselves would be desirable.

Last week's adjustment in Bank Rate seemed to have been accepted at its face value—not, as any reversal of the general direction of monetary policy, but as an adjustment from a rate which was required at a moment of high crisis to a rate more appropriate when that immediate crisis had been surmounted.

As he had said before, unless we could accustom ourselves to adjustments of Bank Rate to the requirements of the moment, without heralding minor reductions from crisis levels as a signal for new excesses of spending, Bank Rate would gradually lose its utility. The authorities must not allow themselves to be inhibited by psychological fears from moving the rate downwards when a decrease was justified on merits. Otherwise they would gradually feel less free to use Bank Rate with vigour, and for as long as might be required, at the decisive moments.

Monetary policy could never be an exact science, but in the last few months their thoughts had been running rather on these lines. On purely technical grounds, with a downward pressure in the domestic short-term market and with the relative development of short-term rates here and overseas, a move from 7 per cent to 6 per cent would have been justified at any time since January. Obviously, the cost of each 1 per cent in Bank Rate was heavy both to Budget and to balance of payments, and this was always an argument against staying too high too long.

Obviously, again, our freedom of manœuvre was restricted whenever we are at levels which appeared rather extreme, which was another argument for not staying too high for too long. On more general grounds, however, they had felt it wise to proceed cautiously. There were strong arguments for not coming down too soon, before an exchange recovery had been consolidated and before the very high short-term rates had played their part in curbing inflation.

These decisions—the decision to maintain the 7 per cent rate until now, the decision to adjust last week, and the decisions which would have to be taken week by week through the year—had to be made in the light of various pointers, many of them looking in different directions.

He was certainly not going to prophesy about what the future held. Whether business activity throughout the world was in for a setback, however, or whether it picked up again after a short hesitation, our job here was clear enough. It was to keep our industry efficient and competitive, so that we could earn our keep in the world's markets.

Sir Lionel Kearns, C.B.E. (past president), in his response, said that the Bank of England was not an impersonal thing, but was interested in their affairs and problems. He went on to commend the work of our Trade Commissioners, who could render valuable assistance.

Because the Machine Tool Trades Association represented the whole of the trade, they were in a position of great strength, and if they went to the Machine Tool Advisory Council they were sure of a hearing.

Competition from various countries, including East Germany, Poland, Czechoslovakia, and Hungary, was increasing, particularly in our export markets, and increased efforts would be necessary in the future if our trade was to be maintained.

The policy of embargo on the export of certain types of machine tools to Russia, China and other countries might well have been right when it was initiated, but it was doubtful whether it was right today.

Many machine tools which were still included in the embargo list were now being made in those countries, and it was possible that the embargo was fostering the competition to which he had referred.

Trade Publications

S. Russell & Sons, Ltd., Bath Lane, Leicester.—Well presented and fully illustrated brochure in which attention is drawn to the various activities of the company. Sections are devoted to the mechanical engineering division, the foundry division, and the structural engineering division.

The Visco Engineering Co., Ltd., Stafford Road, Croydon.—Leaflet giving a brief description of the new Visco M.V. type dry air filter, which is said to occupy less space than the company's C.E. filter, of corresponding capacity, and to be cheaper to install and maintain.

Acheson Colloids, Ltd., 18 Pall Mall, London, S.W.1. Bulletin 100 is an illustrated folder in which attention is drawn to the advantages of "dag" colloidal graphite as a protective lubricant during assembly and running-in. A section is concerned with dry pre-assembly treatment with colloidal graphite or colloidal molybdenum disulphide.

The Nylonic Engineering Co., Ltd., 311b, Rayners Lane, Pinner, Middlesex.—Booklet giving particulars of nylon rod, sheet, tube, mouldings, and extruded sections supplied by the company. Useful technical information is included on industrial nylon, methods of machining, and nylon bearings.

B. Elliott & Co., Ltd., Victoria Works, Willesden, London, N.W.10.—Separate illustrated brochures giving details and specifications of the Victoria Rapidmil No. 2 universal milling machine, the Excel tool and cutter grinder with tilting wheel-head, and the Cardiff 15-in. swing centre lathe.

Fry's Diecastings, Ltd., Brierley Hill Road, Wordsley, nr. Stourbridge. The latest addition to the technical literature issued by this company concerning the properties, design, finishing, and applications of die castings, is a booklet entitled "aluminium alloy pressure die castings." Of the usual high standard, and well illustrated throughout, this booklet includes sections on die casting machines for aluminium alloys; alloys; design features; machining; and finishing processes.

Perdeck Solder Products, Ltd., Abbey Mills, Waltham Abbey, Essex. Technical information sheets on the following products have been issued by the company: Epatam 3311 code B solder paint for hot tinning and sweat soldering; Epatam 3311 tinning salt for hot tinning through rust or other heavy oxide layers, also through grease, paint, and other surface contaminants; Epatam 3311 solder paste (DH series) which can normally be used without the need for pre-cleaning the work surfaces; and Epatam 3311 solder paint for tinning stainless steel in readiness for soft soldering.

The Monarch Machine Tool Co., Sidney, Ohio, U.S.A. 32-page brochure, of high standard, describing in detail the company's series 62 preselector Dyna-Shift lathes and the wide range of equipment available. This publication is particularly well illustrated, and the design and operation of the Dyna-Shift headstock are very clearly explained. The series 62 lathes cover a range with swing capacities over cross slide from 10 in. to 19 in., and length capacities from 30 to 216 in. Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, represent The Monarch Machine Tool Co. in this country.

Benjamin Cromack, Ltd., Wharf Street Works, Shipley, Yorks. In connection with the opening of the company's new Pretoria Works, Carlisle Street, Bradford, a special folder has been issued containing leaflets and bookets on the firm's products and others for which agencies are held. The former include steel drawers, shelves and lockers; Unimet slotted angle constructional material and accessories; cabinets for the machine tool trade; general fabricated structures; machine guards; storage tanks; trolleys and trucks; and ducting. Among factored items may be noted Wrigley trucks, trollies, trailers, wheelbarrows, and light-weight motor trucks.

The British Thomson-Houston Co., Ltd., Rugby. Informative publication on semi-conductor power rectifiers incorporating the GP-C germanium rectifier cell. Attention is drawn to the simplicity and high efficiency of these rectifiers, and to the exacting standards of cleanliness and purity of materials necessary for their successful manufacture. For example, the germanium crystals are refined until the impurities represent less than "one ten-millionth of one per cent." Illustrations of the semi-conductor power rectifier factory are included, and there are sections devoted to the semi-conductor rectifier cell, connections and waveforms, naturally-cooled and fan-cooled semi-conductor power rectifiers, and general data.

News of the Industry

Manchester and District

CRAVEN BROTHERS (MANCHESTER), LTD., Reddish, Stockport, have a considerable variety of heavy machine tools in progress, some of which are destined for export. Among the machines ordered since our last visit may be noted heavy-duty lathes, ranging from 16¼- to 72-in. centres, including a 36/72-in. centre break lathe, a 42½-in. lathe with taper turning equipment, to admit 40 ft. between centres, and a heavy-duty 33¾-in. centre roll-turning lathe. Orders for vertical boring and turning mills cover a number of 5-, 6- and 7-ft. machines, of new design, which have independent electrically-driven, push-button-controlled, feed motions to the rams, also several standard mills in the 8- by 12-ft. range.

Railway machine tools ordered include three 4-ft. carriage and wagon wheel lathes, axle journal turning and burnishing lathes of new design, with dual headstocks driven by separate synchronized motors, and provision for hydraulic application of driving pressure to the two ends of the axle. Other equipment on order includes a propeller boss boring machine; a 76-in. swing portable radial planing machine; a 27-in. centre roll tenon and wobbler end milling machine; a 10- by 7-ft., independently-driven, rotary work table for a large floor-plate-type horizontal boring machine; and additional equipment for large lathes, including auxiliary deep-hole boring and grinding heads.

In addition, orders have been received for major modification of large tube boring machines to enable them to be employed for high-speed boring and trepanning operations with carbide tools; for the reconditioning of various types and makes of machine tools, including planing machines; and for the complete reconstruction of a very heavy, 26-in. centre, roll-turning lathe.

In the works we noted, in course of construction, the first half of a second special 4-column horizontal boring, facing and milling machine, with four 5-in. diameter spindles, as described in MACHINERY, 88/390—6/4/56. A 30-ft. vertical boring and turning mill, weighing approximately 210 tons, was nearing completion for Australia. With a 22-ft. diameter table, this fixed-column machine will swing work up to 30 ft. 3 in. diameter between the columns. It has an 80-h.p. variable-speed motor drive, with three gear changes, which provides a range of spindle speeds from 0·25 to 7·5 r.p.m. The feeds to the rams and saddles are driven by independent electric motors at the ends of the cross-slide, and there are 12 gear changes. The feed motors are synchronized to vary in speed in relationship to that of the main table motor, to give constant feeds in inches per rev. of the table, regardless of the table speeds. Work up to 10 ft. in height is admitted under the tool-holders.

We also noted a rotary-head type crankpin turning machine for operations on the pins and webs of large, roughly-slotted, diesel engine crankshafts. The height of centres is 60 in., and the 23 ft. 6 in. long bed has two V-type stays for supporting the cranks. There is a 62-in. diameter hole through the headstock spindle, and pins from 6 to 10 in. diameter can be turned

Among the standard vertical boring and turning mills in progress, we noted machines of 5-, 6-, 12- and 18-ft. capacity, and standard lathes included a 33¾-in. centre roll-turning type, also one 36¼-in. and three 42½-in. centre machines. A 4-ft. carriage and wagon wheel lathe and a 5-ft. 6-in. locomotive wheel lathe were nearing completion. Planing machines, of the spiral-drive type, at present in hand include 24- by 10- by 8-ft., and 25- and 20-ft. by 6-ft. sizes. Several 10-in. precision hob sharpening machines, as described in MACHINERY, 91/543—6/9/57, were seen on test in the tool-room.

In the firm's temperature-controlled workshop, we noted, under test, a large horizontal-type turbine pinion hobbing machine, which will hob pinions up to 40 in. diameter. The overall length of pinion admitted is 12 ft. and the maximum hob slide travel, 10 ft. This machine has been built to B.S. Grade A limits. Also under test in this department, was a small motor-driven machine for improving the running performance of straight and spiral bevel gears, ranging from 3 to 14 in. diameter, with shafts at 90 deg., or at any other angle between 75 and 105 deg. A mating pair of gears is run together at the correct shaft angle, first with lapping compound and later with oil.

CROWTHORN ENGINEERING CO., LTD., Reddish, Stockport, are fully employed on orders for lathes ranging from 7½- to 20-in. centres. Export business is being done with Australia, New Zealand, Canada, South Africa, Iran and the Crown Agents for the Colonies. A new 10½-in. centre heavy-duty lathe is in course of development, and we

also noted in progress a 10½-in. centre lathe with copying equipment, a 12½-in. centre by 22-ft. 9-in. long lathe for the British Transport Commission, for Fleetwood Docks, and an 18-in. centre by 22-ft. 9-in. long lathe for the Goole Shipbuilding Co., Ltd. Orders are also in hand for the firm's 19½-in. stroke shaping machine. The latest addition to the plant is a Kitchen & Wade 5-ft. radial drilling machine.

J. Halden & Co., Ltd., Reddish, Stockport (head office—8 Albert Square, Manchester), are developing a new metal filing cabinet for the storage of ordnance survey maps and large drawing sheets, also a special drawing table with straightedge, which provides accommodation for drawing instruments and books. We hope to make further reference to these new items in due course.

Rhodes, Brydon & Youatt, Ltd., Stockport, are working under considerable pressure to meet the heavy demand, on both home and export account, for a wide variety of pumps. In the works we noted small, medium and large capacity pumps, of both the horizontal and vertical types, for a wide diversity of applications. Stainless steel pumps are particularly prominent, also multiple stage, high-lift pumps, and centrifugal impeller, self-priming pumps. Our attention was drawn to vertical Mopumps for handling metals with fairly low melting points, such as tin, lead and sodium, and molten inorganic chemicals, including sodium and potassium nitrates and caustic soda, also various heat transfer media. This firm recently acquired the works, plant and business of Furnival & Co., Ltd., Reddish, Stockport, and the production of guillotine shearing machines for the paper-making industry, and various sub-contract work, is being carried on under the former title. Mopump products are to be shown at the forthcoming Chemical and Petroleum Exhibition to be held at Olympia, London, from June 18 to 28.

Dronsfield Brothers, Ltd., Atlas Works, Oldham, have recently developed a wormwheel hobbing machine for wheels up to 12 in. diameter Of simple design, this high-production machine is also suitable, it is claimed, for use in the average machine shop, where a variety of wormwheels may be required in limited quantities. The maximum hob size is 3½ in. diameter by 4 in. long, and the maximum centre distance between the hob and work is 8 in. Of 9 in. diameter, the table is bored 2¼ in. diameter. Drive is taken from a 2-h.p. motor and there are four hob speeds from 48 to 160 r.p.m. We hope to make further reference to this machine. H. B.

Czechoslovak Trade Bulletin

The Chamber of Commerce of Czechoslovakia, Prague, have been publishing, since January of this year, a monthly bulletin, entitled "Economic News Service," in the English and German languages, which gives facts and figures concerning the current position of the Czechoslovak economy. This bulletin is of pocket size, and each page is perforated, so that it can readily be torn out and filed for future reference, if required. In addition to trade figures relating to the various sections of industry, interesting news items are included concerning new developments, trade agreements, and important import and export orders.

The value of Czechoslovak imports and exports has been steadily rising since 1948, and according to the March issue of the bulletin, industrial machinery, including machine tools and small tools, accounted for 44·5 per cent of total exports in 1957, and 18·8 per cent of the imports. In this particular year, exports included 8,481 metal-working machines, 15,858 motor cars, 2,602 commercial vehicles, 80,119 motor cycles, 153,342 bicycles, and 14,445 wheeled tractors. Imports in 1957 included 10,549 motor cars, and, as compared with previous years, there were increased imports of various types of machinery required for the modernization of Czech industrial plants.

The first 200 Skoda S440 passenger cars, which have 1,089-cc. engines, were delivered in January for the Canadian market, and the first of an order for three 15-MW. turbo-generator sets has recently been shipped to India. A contract has now been signed for the construction of a cane sugar refinery in Ceylon which will have a capacity of 1,300 tons of sugar per 24 hours, and Pakistan has ordered 3,700 3-phase electricity meters. Contracts are being negotiated with China for a 12,000-ton press, and for the construction of a ceramics plant with an annual capacity of 2,600 to 3,000 tons of industrial and artistic porcelain. A third contract is concerned with two turbines for a hydro-electric power station of 150 MW. capacity. From Greece, an order has been received for 600 tractors, and diesel engines and diesel generator sets to the value of 500,000 U.S. dollars are to be supplied to Argentina.

The Skoda works at Plzen, in Czechoslovakia, it may be noted, have now completed the prototype of a 3,200-h.p. gas turbine locomotive designed for a speed of 80 m.p.h. on passenger services. It has six driving axles in two under-carriages, and the mechanical transmission which is incorporated is said to have enabled the weight of the locomotive to be considerably reduced.

For the Czechoslovak motor car industry, induction heating equipment is to be imported for use with five forging presses with capacities from 1,500 to 4,000 tons, and five forging machines with capacities from 200 to 2,000 tons. West German, Belgian and Austrian firms are stated to be competing for this important order.

Czechoslovakia desires to increase imports of industrial machinery and equipment, including machine tools, from Great Britain, and Mr. R. Kubicek, deputy general manager of the Czech trade organization, Strojimport, Prague, recently visited this country to ascertain the possibilities of increased trade. Enquiries have been made in connection with industrial equipment to the value of nearly £3 million, and Czech machine tool requirements have been discussed with the Machine Tool Trades Association in London. In 1957 Czech imports of machinery of various kinds from Great Britain totalled only £600,000, whereas from Western Germany they amounted to £5½ million. Particular attention is drawn by the Czech import organization to the intensive selling methods adopted by firms in West Germany, who take the initiative in making direct contact with the factories in Czechoslovakia, arranging demonstrations of their products, and supplying adequate technical literature, often in the Czech language. In addition, many West German firms take part in the Czech Trade Fair held annually in Brno. The general attitude of Czechoslovakia towards trading with Great Britain is stated to be very favourable, and it is suggested that greater efforts in this direction could be made, with advantage, by companies here.

E.I.A. Display at Crawley

A successful one-day display of engineering products was held recently at Crawley by the Sussex Group of the E.I.A. The opening ceremony was performed by Sir Thomas Bennett, K.B.E., F.R.I.B.A., chairman of the Crawley Development Corporation, who was introduced by Mr. A. S. Ladley, chairman of the Sussex Group, E.I.A. The Rt. Hon. Viscount Davidson, P.C., G.C.V.O., C.H., C.B., president of the E.I.A., expressed thanks to Sir Thomas.

Some 58 members of the Association participated in the event, which was well attended and served to draw attention to the wide range of engineering work produced in Sussex and neighbouring counties. On several stands there were examples of jigs, fixtures, press tools and moulds. Firms engaged in the production of castings were well represented, as were several others which specialize in sheet metal fabrication. Gauges and measuring instruments of many types were on view, including equipment for checking the contoured surfaces of gas turbine blades. Shown for the first time at an E.I.A. display, was a recently-designed dynamic capacitance meter which is capable of measuring vibratory movements, for example, from 5 micro-inches up to several inches. The exhibits, which were arranged on stands of uniform size, also included diamond impregnated wheels, soldering equipment, name-plates, sub-miniature co-axial electrical terminals, flame profiling equipment, engineers' small tools, portable power tools, and electroplated products. On other stands there were displays of metal pressings, small bench-mounted machine tools, plastics mouldings and extruded parts, engineers' patterns, ball and roller bearings for a wide range of applications, anti-vibration mounts for machine tools, gears, wirework, industrial safety equipment, reground hobs and milling cutters, small air compressors, and slotted metal angle sections.

Rockwell Machine Tool Exhibitions

The Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, are organizing two exhibitions of modern production and tool room machines as follows:

At the works, and by courtesy of Jack Flaherty & Co., Ltd., 10 Canal Street, Waterloo Road, Stockport, from April 16 to 25, 9.30 a.m. to 5 p.m. (Thursday to 7 p.m., Saturday 9 a.m. to 12 noon). Exhibits will include Thiel tool-room machines, among which may be noted a duplex miller, a punch shaper, and a new filing machine; Essex tapping machines; Colchester, Holbrook, and Smart & Brown lathes; a Jung automatic internal grinder; a Schutte swivel-head cutter grinder; an ABA surface grinder; Werner production milling machines; an Eleroda spark erosion machine; an Essex 12-in. bandsaw; a Milnes heavy-duty fine borer; a range of press room equipment; and a British-built No. 28 U.S. multi-slide machine which is being shown in this country for the first time.

The second exhibition will be held at the works, and by courtesy of Millhouses Engineering Co., Ltd., 968, Abbeydale Road, Sheffield, 7, from April 30 to May 9, 9.30 a.m. to 5 p.m. (Thursday to 7 p.m., Saturday 9 a.m. to 12 noon). Equipment on view will include two Thiel tool-room millers; two Thiel filing machines (one of the new design mentioned above); a Thiel punch shaper; an Eleroda spark erosion machine; and an Essex bandsaw.

Tickets of admission will not be required for either of these exhibitions.

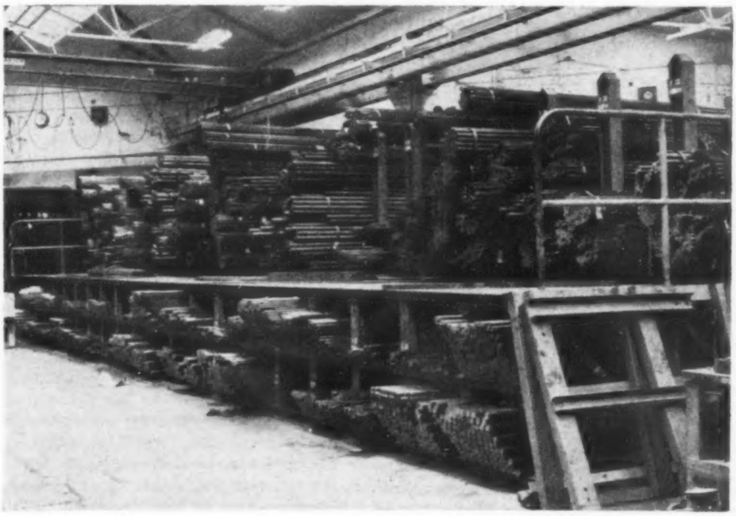
Macready's Metal Co. Premises

In previous news paragraphs in MACHINERY, reference has been made to the extensions to the premises of Macready's Metal Co., Ltd., 131 Pentonville Road, London, N.1, which have been under construction during the past three years. Although further extensions to the Usaspead stores are planned for completion when conditions permit, the greater part of the building work has now been finished and the new administrative offices and warehouse are in use.

Recently, the new premises were formally opened by Mrs. R. E. J. Macready, wife of the managing director of the company, who unveiled the foundation stone of the main building in the presence of the directors, other members of the firm, and about 100 guests. The new buildings were designed by, and erected under the supervision of, Mr. J. K. Greed, F.R.I.B.A., M.I.R.A. More than 150 piles were sunk to provide adequate support for these buildings, which were specially constructed to withstand the effects of heavy concentrations of metal in the warehouse. Additional space afforded as a result of the rebuilding programme has enabled the stock of metal in the warehouse to be increased, and the quantity of steel normally amounts to more than 5,000 tons, in a wide range of specifications.

The delivery area over which the company's fleet of 7-ton diesel-engined lorries operates is being steadily expanded, and already embraces the Home Counties, Wiltshire, East Anglia, and much of the South Coast. Improved facilities for handling the heavy loads received into and dispatched from the warehouse have been provided, and in this connection it may be noted that Ransomes battery-driven elevating platform trucks, of 2 tons capacity, are being used with success to move loads of steel, on stillages, within the warehouse, where, because of site conditions, manœuvrability of transporters is of considerable importance. Overhead cranes are used to move steel, in 1-ton loads, into and out of the racks in one of the new storage bays, as seen in the accompanying illustration. It may be recalled that this company introduced a service, more than three years ago, for supplying users with cut lengths of bright steel, in popular sizes, "off the shelf." To meet this need, large racks, of the pigeon-hole type, were installed, with letter and number coding at the openings, to expedite the location of specific sizes of steel, as required. This service has proved popular, and the range of cut lengths available has been extended.

Large stocks of Usalloy alloy steels are held, and include forged blanks, and bars in a wide variety of sizes. Among the steels, there are types suitable for many applications in the aircraft and motor vehicle industries, for the manufacture of components which are subjected to shock loading and severe service conditions. Machines are installed in the warehouse for producing cold-sawn bright blanks, which are stocked in sizes from 3 in. diameter by ½ in. thick, up to 12 in. diameter by 6 in. thick. Profiled plate, spring steel, cast iron bars, silver steel, bronze, stainless steel, and shim-steel can also be supplied.



A View in the New Warehouse of Macready's Metal Co., Ltd., Showing the Storage Arrangements for Steel Bars

---

THE VALUE OF EXPORTS OF MACHINERY of all types, other than electric, from this country in February was £46,701,275 as compared with £46,238,154 in February, 1957. Of this total £4,008,391 went to Australia, and £3,803,658 to India.

Industrial Notes

Davy and United Engineering Co., Ltd., have moved to new offices at Darnall Works, Sheffield, 9 (telephone number, Sheffield 49971).

Thomas Mercer, Ltd., have opened new premises in Old London Road, St. Albans, for the production of standard and special air gauging units.

Clarkson (Engineers), Ltd., Nuneaton, inform us that their Canadian subsidiary, Clarkson Engineering (Canada), Ltd., have moved to new premises in Toronto, at 767 Warden Avenue, Scarborough.

Elgar Machine Tool Co., Ltd., inform us that the correct postal address of their new Midlands office is 1075 Kingsbury Road, Erdington, Birmingham, 24 (telephone number, Castle Bromwich 3781/2).

Vickers-Armstrongs (Shipbuilders), Ltd., have received a £3,000,000 contract to build the largest privately-owned dry dock in Britain at Hebburn-on-Tyne. It will be 850 ft. long and will have a 145-ft. wide entrance.

An Auction Sale of Machine Tools and miscellaneous stores from M.O.S. Storage Depot, Ruddington, Notts, will be held on April 22. The auctioneers will be Walker, Walton & Hanson (Dept. N), Byard Lane, Bridlesmith Gate, Nottingham.

Alfred Imhof, Ltd., Ashley Works, Cowley Mill Road, Uxbridge, Middlesex, have recently added a forced ventilation rack to their standard range. This enclosed rack is designed to provide effective cooling. A powerful blower unit is fitted to the base and the doors are semi-sealed to ensure efficient and economic cooling.

Firth Cleveland Finance, Ltd., is the title of a new company which has been formed by the Firth Cleveland Group. It will be concerned with financing hire purchase transactions for all sections of the motor trade and for industrial plant. The offices are at the headquarters of the Group, 8 Cleveland Row, London, S.W.1.

Amber Chemical Co., Ltd., 11a Albemarle Street, London, W.1, have introduced a new additive, known as Amber SSR.115, which is in the form of a fine powder and is intended for use with solid fuel. It is claimed that it ensures a substantial reduction of sulphur corrosion, improves boiler availability, and alleviates air pollution.

Birlec, Ltd., Tyburn Road, Erdington, Birmingham, 24, have received an order from the Newport Division of the Steel Company of Wales for electric furnaces to the value of approximately £500,000. These furnaces will be employed in connection with the production of special steels for the electrical industry.

Chamberlain Plant, Ltd., is the title of a new company to which the plant sale and hire activities of Chamberlain Industries, Ltd., are being transferred. This change is in accordance with the general policy of expansion of the Chamberlain Group of companies. With offices and works at Crown Works, Southbury Road, Enfield, Middlesex, the new company will handle the sales of the complete range of Staffa mobile and shop cranes, the Jenbach compressors, and a variety of contractors' plant. It will also operate and maintain a large plant hire fleet.

The Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1, are to hold an exhibition, which will include displays and working demonstrations, at the Grand Central Hotel, Belfast, from April 14 to 18. This exhibition, which will be designed to show the latest uses and developments of nickel, nickel alloys and related materials, will be open from 10 a.m. to 7 p.m. daily. The displays will be concerned, for example, with corrosion resistance, surface protection, high magnetic permeability, weldability, controlled expansion, and mechanical properties at temperatures between 900 deg. C and sub-zero.

The Professional Engineers Appointments Bureau, 39 Victoria Street, Westminster, S.W.1, in its report for 1957, states that a steady demand for engineers of all grades was maintained during the year although some reduction in the numbers of vacancies notified became apparent during the later months. Enrolments of engineers with the Bureau were generally similar to those of 1956, although not as high as in the two previous years. The numbers of engineers submitted to the notified vacancies were similar to those of last year but fewer than in 1955.

Towler Brothers (Patents), Ltd., Electraulic Works, Rodley, Nr. Leeds, will participate in the Hanover Fair, which is to be held from April 27 to May 6. Their exhibits will include an all-hydraulic valve station for controlling a 7,200-ton bending press; a desk providing single lever control for an 800-ton hydraulic forging press; a 140-h.p. oil hydraulic pump; a packaged hydraulic unit representative of a recently introduced range; and a D.C. solenoid-operated directional control valve. There will also be a demonstration drawing press operated by Towler oil-hydraulic pumps, and arranged for Autodraulic all-hydraulic push button control.

Solartron-Ericsson Sales Agreement.—The Solartron Electronic Group, Ltd., Thames Ditton, Surrey, and Ericsson Telephones, Ltd., New Basford, Nottingham, have concluded a sales agreement whereby Ericsson nucleonic and electronic instruments and components will henceforth be distributed by the extensive Solartron sales organization. The arrangement will operate in most countries of the world including the United Kingdom but excluding Scandinavia and South Africa. The range of Ericsson products to be handled includes cold cathode tubes, relays, counting equipment, scaling units, interval timers, pulse generators, and crystal oscillator and frequency dividers.

Coming Events

Junior Institution of Engineers. April 11, at 7 p.m., at the Institution, Pepys House, 14 Rochester Row, Westminster, S.W.1; paper on "Industrial Applications in Connection with Television," by T. M. C. Lance. *Sheffield and District Section.* April 14, at 7.30 p.m., at Livesey Clegg House, 44 Union Street, Sheffield; paper on "Linear Measurement," by F. E. Clarke.

Personal

MR. F. BAILLIE has been appointed works manager of the Scottish factory of IBM United Kingdom, Ltd., where electric typewriters, punched card accounting machines and the IBM 650 computer are produced.

MR. F. P. LIEBERT, B.Sc. (Tech.), A.M.I.Prod.E., has been appointed works manager of the Rugby and Whetstone (Leicester) factories of The English Electric Co., Ltd., Marconi House, Strand, London, W.C.2. He will be responsible to the general manager of these factories, Mr. E. M. Price.

MR. DENIS S. PLAYER has been elected deputy to Mr. Sydney Player, chairman of The Newall Engineering Co., Ltd., Peterborough, and its subsidiaries: Optical Measuring Tools, Ltd., Maidenhead; Keighley Grinders (Machine Tools), Ltd., Keighley; James C. Kay & Co., Ltd., Bury; and The Newall Machine Tool Corporation of Canada, Ltd. After receiving early technical training in the U.S.A. and completing an engineering apprenticeship at the Newall factory, Mr. Player was appointed to the board of directors 20 years ago.

In the capacity of managing director, he inaugurated the activities of Optical Measuring Tools, Ltd., and in 1947 was responsible for the formation and organization of Newall Group Sales, Ltd., the selling company for the Group.

Mr. Denis S. Player

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £135; clean heavy copper, untinned and free from lead and solder, £128; second grade copper wire, £122; clean light copper £119; braziery copper, £108; gunmetal, £115; brass mixed, £80; lead, net, £59; zinc, £27; cast aluminium, £91; old rolled aluminium, £124; battery lead, £32; unsweated brass radiators, £66; hollow pewter, £495; black pewter, £365.

MIDLANDS.—Difficult trading conditions still persist in the Midlands and allocations from steelworks, blast furnaces and foundries fall well below the amounts requested by merchants, whose yard stocks of processed scrap are increasing daily.

The larger scrap businesses are naturally loading their own material to the limits specified, with the result that smaller merchants, who have no direct orders from steelworks and other consumers, are experiencing even greater difficulty in moving their stocks.

Heavy steel scrap to No. 1 and 2 specifications can be loaded against allocations, but even in remote steelmaking areas, far from the Midlands, deliveries are not required in excess of the usual intakes. Hydraulically compressed light steel cuttings are being cleared steadily as No. 4 bundles, but output, nevertheless, exceeds demand.

Chipped turnings are being delivered to blast furnaces but "bushy" turnings cannot be placed, apart from odd loads here and there. Many merchants find it necessary to tip loads in this area, with the result that most "bushy" turnings are cleared from factories on a "free of charge" basis. Shortage of permit loading labels for light iron scrap is causing concern, and there are large tonnages of loose scrap which cannot be moved from this area.

Cast-iron scrap and short heavy steel scrap are plentiful, but, here again, trading is restricted by reason of the small intakes at the local foundries, which are reluctant to accept deliveries for stock.

As would be expected, "refusals" of wagons are frequent, because buyers are only prepared to accept scrap exactly to specification, and it is essential for loaders to pay very close attention to the preparation and loading of all grades.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., Commercial Road, E.14.
‡ Subject to market fluctuations.

Books Received

The B.E.A.M.A. Catalogue (4th Edition). Published for The British Electrical & Allied Manufacturers' Association (Inc.), 36 Kingsway, London, W.C.2, by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. 962 pp. [Price £6.]

The fourth edition of this important catalogue has been issued earlier than usual to ensure that copies will be available for distribution at the Brussels Universal and International Exhibition, where the British Electrical and Allied Industry will have a large collective exhibit in the British Industries Pavilion. Attractively presented, with full cloth binding, it is divided into thumb-indexed sections for ease of reference. A standard format has been adopted for the descriptive catalogue pages and distinctive second colours have been employed to differentiate between the sections which are concerned with electric power plant; electrical equipment for industry, transport, and communications; and domestic and commercial electrical appliances, lighting, accessories, and installation material.

In addition there is a five language (English, French, German, Portuguese, and Spanish) glossary of technical terms which provides a comprehensive cross reference. Another section provides a classified buyers' guide, with more than 1,300 headings, covering the range of equipment made by British firms in this field. There is also a trade directory which gives the principal addresses of all B.E.A.M.A. member-firms in the United Kingdom, and subsidiary or branch offices, together with more than 4,700 names and addresses, grouped territorially, of members' overseas branches, representatives, and agents.

Machine Tool Share Market

Stock markets were dull and uncertain, in quiet conditions, during the period under review, and an easier trend was displayed in most sections.

The gilt-edged section was mainly subdued but prices followed a steady course with only narrow fluctuations.

Activity in the commercial and industrial share sections remained at a low level and although prices showed some irregularity, the majority of changes were to moderately lower levels, on balance.

Among machine-tool issues, Armstrong Stevens lost 6d. at 7s. 3d.; British Oxygen, 1s. at 34s.; Chas. Churchill, 1½d. at 4s. 4½d.; Kayser Ellison, 4s. at 45s.; and Ambrose Shardlow, 1s. 6d. at 32s. On the other hand, Churchill Machine Tool advanced 6d. to 18s.; Coventry Gauge & Tool, 3d. to 12s. 9d.; Kerry's (Gt. Britain), 3d. to 6s.; and John Shaw & Sons (Wolverhampton), 3d. to 11s. 7½d.

Coventry Machine Tool Works, Ltd.—Dividend 17½ per cent (same).

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	28/3
,, ,,	5% Prf.	£1	14/6*xd
Arnott & Harrison, Ltd.	Ord.	4/-	14/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	18/9
,, ,, ,,	6% Cum. Prf.	£1	17/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	24/6
,, ,, ,,	5% Cum. "A" Prf.	£1	15/-
,, ,, ,,	6% Cum. "B" Prf.	£1	17/6
,, ,, ,,	4% 1st. Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	34/-
,, ,, ,,	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/6
Broom & Wade, Ltd.	Ord.	5/-	9/9
,, ,,	6% Cum. Prf.	£1	17/9xd
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/4½
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/3
,, ,, ,,	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/4½
,, ,, ,,	6% Cum. Prf.	£1	26/3†
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/-
,, ,, ,,	6% Cum. Prf.	£1	18/9
Clarkson (Engrs.), Ltd.	Ord.	5/-	11/-xd
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/6xd
,, ,, ,,	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	12/9
,, ,, ,,	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	9/-
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
,, ,,	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/6
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-xd
Greenwood & Batley, Ltd.	Ord.	£1	46/10½

COMPANY		Denom.	Middle Price
Harper (John) & Co., Ltd.	Ord.	5/-	13/6
,, ,,	4½% Red. Cum. Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	62/6xd
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/6
,, ,,	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
,, ,, ,,	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	45/-
,, ,, ,,	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/-
Kitchen & Wade, Ltd.	Ord.	4/-	10/3
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/3
Modern Engineering Machine Tools, Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	5/-
Newman Industries, Ltd.	Ord.	2/-	2/9
,, ,,	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	4/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/3
,, ,, ,,	5½% Cum. Prf.	£1	24/6
Pratt (F.) & Co., Ltd.	Ord.	5/-	20/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	32/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/7½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	35/-
,, ,, ,, ,,	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	4/6
Tap & Die Corporation, Ltd.	Ord.	5/-	7/9
,, ,, ,,	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	74/3xd
,, ,,	5% Cum. 1st. Prf.	£1	15/6
,, ,,	5% Cum. 2nd Prf.	£1	24/3
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.